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ABSTRACT

Work with PLATO, a computer-based teaching system which provides a means for individualizing instruction, is described. Children sit at terminals and respond to directives and questions on the screen by touching it or by typing a message. PLATO responds, and prescribes work in accordance with the child's previous performance. Curricular materials for teaching mathematics to pupils in grades 4-6 have been programmed, with strands on graphs, whole numbers, and fractions. How three children in one classroom interacted with PLATO is described and discussed. The vignettes try to portray the complexities of implementing PLATO mathematics in the classroom. The teacher's reactions to the use of PLATO are presented, along with excerpts from the logs she maintained for 2 years. An appendix lists the lessons available on PLATO. (MNS)

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Plato and Fourth Grade Mathematics

Bernadine Evans Stake

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PREFACE

"DEAR PLATO. I HAD A GOOD DAY." A child's note after a session on PLATO represents to me the overall impression that I have come to feel after two years of observing in classrooms where children used Plato terminals to augment their math instruction. Educators are continuously searching for ways to improve instruction that will improve learning. The capabilities of children are more than educators are equipped to provide for in classrooms, but educators have real doubts about using technology to develop those capabilities.

SARA
A GLIMPSE OF SARA AT A PLATO TERMINAL

"I don't know my sixes, and I don't want to do them."

October 28, 1975 (Afternoon)

One of PLATO's[1] problems was with its "extended core storage." Everybody called it "ECS." Terminals were generally used in the afternoon more than in the morning. When all the computer's core storage was in use new arrivals might not be able to access the lesson they needed. Before PLATO could make a lesson available to a student, the lesson had to be moved from the computer's disc memory (which represented a kind of vast storehouse of computer-programmed lessons), into the extended core storage, a smaller but more accessible portion of computer memory. But if ECS was filled with lessons for students who were already signed on, a newly-arriving student might not be able to get the specific lesson that he or she needed. In such a case the student just had to keep trying until some ECS opened up for them. (This was very much like getting a busy signal on the telephone, and having to re-dial a moment or two later on.)

Sara and three other children were having exactly this problem. Sara tried various keys. She pushed the CLEAR button and tried the touch panel. All to no avail. She asked Ms. Hamilton for help and was told to try different approaches, such as turning the terminal off, waiting a few minutes and then turning it on again. (This was in fact the correct remedy for a different problem; in the present

[1]PLATO - Programmed Logic for Automatic Teaching Operations

case it could not have helped.) Sara tried every approach a couple of times methodically.

Sara was relaxed and calm to begin with, but became a bit frustrated when PLATO did not respond to her attempts to access a lesson. She hit the keys harder and said, "PLATO, you're wasting my time."

After several minutes of waiting, then checking, she went to her desk and brought a Language workbook back to the terminal. She worked in the workbook as she sat waiting for PLATO to become less busy. She was learning the limitations of technology.

October 29, 1975 (Morning)

Since Sara had missed her PLATO turn the day before she was one of the first to be "on" the next morning. Ms. Hamilton was diligent in her effort to see that PLATO time was shared in an equitable manner.

Sara smiled as she worked. She did an ADDITION CHECK-UP (Whole Numbers, B12).[2] She had no trouble following directions or working the problems. Sara typed slowly. She read the directions slowly and carefully as she worked. Her second lesson was RUBBER STAMP (Whole Numbers, D1). Again she advanced through the lesson with no trouble.

Her third lesson was PARKING LOT (Whole Numbers, D26). Sara finished the "fives" easily, PLATO informed her that she was ready

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[2]The description of lessons in the three Math Strands are in the publications Description of Graphing Strand Lessons by Donald Cohen and Gerald Glynn, Computer-Based Education Research Laboratory, University of Illinois, Urbana, Illinois, June, 1974; Description of PLATO Whole Number Arithmetic Lessons by Bonnie Anderson Seiler and Charles S. Weaver, Computer-Based Education Research Laboratory, University of Illinois, Urbana, Illinois, June, 1976; The Fractions Curriculum--PLATO Elementary School Mathematics Project by David Kibby and Sharon Dugdale, Computer-Based Education Research Laboratory, University of Illinois, Urbana, Illinois, March, 1975.

for the "sixes." Sara turned to me and said, "I don't know the sixes and I don't want to do them." I knew that most children her age were working on the sixes so I asked her if she didn't want to try them. She said she did not want to.

Not listening, PLATO presented her next problem: 5 X 6. Sara worked it even though she had said she wasn't going to. Her answer was correct. She clapped her hands and seemed happy with herself.

The authors of the lessons had structured them in such a way that most children continued to be successful, but at the same time, challenged rather than bored. In this instance Sara was afraid to try to multiply by 6. PLATO presented 5 X 6 and since Sara knew the 5's she worked the problem; was successful, happy and confident at least for the moment. The lessons were structured so that sequencing provided logical direction for the child. At the same time that Sara was saying that she wouldn't do the 6's, PLATO continued to present the lesson and hold her attention. Sara was helped past the threatening situation. PLATO managed to create a positive situation out of a potentially negative one. While this did not always occur with PLATO, from observation it appeared to be a most common case.

Sara then chose SPEEDWAY (Whole Numbers, B1) from the game slot. She read the directions aloud to herself as she worked at the terminal. Kathy, who sat next to Sara, bragged to Sara about how fast she was working. Sara looked over at Kathy's terminal and asked Kathy which race to do on SPEEDWAY. Kathy said, "Do GRAND PRIX." Sara chose GRAND PRIX. Kathy and she discussed the game. Sara entered herself

as "RACER" and named her opponent, "SLOW POKE." RACER worked hard to win. She missed 4 X 1. She got it right on the second try. When PLATO took time-out to say, "Great, you got it right this time," Sara said, "OK, OK," indicating "let's get on with the race--I don't need to be told I'm right."

NOTE: The teacher's name, the school names and all student names are psuedonyms.

NINETY NINE, ONE HUNDRED, ONE THOUSAND
RATIONALE FOR PLATO MATHEMATICS

PLATO is a computer-based teaching system which provides a means for individualizing student instruction. Lessons have been designed to allow students to work at their own pace.[1] The lesson performance is recorded and evaluated at least in part by the computer located at the Computer-Based Educational Research Lab. Children sit at a terminal with a typewriter keyboard and a "touch panel." The child responds to directives and questions on the screen by touching it or by typing a message onto the screen. PLATO responds to the child's directives and prescribes work in accordance with the child's previous performance. Children learn mathematics as they interact with the terminal to work the lessons presented on the screne. Animated graphics help keep attention on the screen.

Certain curricular materials have been programmed for the teaching of mathematics. At this time (1977) these have been designed for fourth, fifth, and sixth grade children in American classrooms. The curriculum has been developed in three strands: a graph strand, a whole numbers strand, and a fractions strand. These materials are the result of development and experimentation at the University of Illinois. The work has been sponsored in large part by the National Science Foundation and is being evaluated by the Educational Testing Service. Not only at the scene but across the country there is great curiosity about

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[1]Students working at their own pace can, of course, mean trouble, especially if some students allow themselves to fall far behind. To guard against such problems, PLATO reports to teachers whenever a student seems to be making unsatisfactory progress.

this extensive innovation. Teachers and children alike respond to the questions PLATO asks and even to the territory in the classroom PLATO commands.

The introduction of PLATO into the classroom creates a considerably different way of bringing children and materials together for instruction in mathematics. PLATO occupies a fixed space in some corner of the classroom where children come to interact with it. The space around the terminals becomes the locus for highly purposive work in an uncommon classroom culture.

Ours is a society that honors numbers as well as the written word. Many people who cannot use either numbers or words effectively are out of the mainstream of communication. There is power in numbers and words which almost everyone yearns to share.

Numbers are particularly powerful. They are used to predict the outcome of elections and to justify expenditure of funds. Numbers in research are used to support claims for different theories of learning. Economic health is measured by gross numbers. Higher numbers represent more wealth, more power, or on the other hand more heart attacks, and more pollution. School policies are often determined by statistics purporting to show costs and benefits. When numbers possess such apparent power they can be used to intimidate people and to exclude people from privilege. Complex statistical reports and high scores on tests can manipulate people's decisions. The claims made by such reports and tests are often accepted even when the statistics and tests are not understandable.

The computer is a tool that can be used to simplify and restructure numerical information to make it more easily understood. At times however, the use of the computer does not simplify, but complicates and confuses. Computers can be used capriciously, merely to impress people with the complexity of technology.

Since numbers and computers are not always used effectively, it is important to show young people how numbers and computers can be used for their benefit. Experience with PLATO shows that children who have even a bit of familiarity with computers soon gain a healthy perspective regarding their use.

Using computer aided instruction in the schools is one way that attitudes toward the technology of machines can be put in perspective. When children are introduced at an early age to both the benefits and the limitations of the computer, they can more easily recognize both. In classrooms I visited, children using PLATO Mathematics learned to recognize when the computer was wrong. They also tried to explore and determine their own use of the machine. In fact, in some classrooms, children obtained "author codes."[2] They explored the great realm of games and lessons that were on PLATO.

The PLATO communication system provided a mechanism for learning. Using computers in math education not only increased the child's ability to understand the number system, but it gave the

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[2]"Author code" is the mode a person used to access the PLATO system to write lessons as well as actively participate in lessons that others write. A "student code" is restricted to specific lessons, according to a pattern prescribed by the teacher, subject to constraints of availability and computer system policy.

child an early introduction to the complexities of technology. Children learned about mathematics and at the same time used the PLATO system to share their knowledge with others.

The fiscal costs of equipping children to live in a technological society may be high, but social costs to society might be higher. It is time to consider how to equip people for the proper use of numbers and computers.

CERL. . .THE THREE STRANDS

CERL stands for the Computer-based Education Research Laboratory at the University of Illinois. CERL is the home of PLATO and PLATO mathematics. The lab is large. Many people there work on hardware, courseware and delivery. This report is primarily concerned with the people who develop courseware and deliver PLATO services to elementary schools.

In the early 60's Donald Bitzer developed the plasma display panel--the single most unique feature of PLATO--permitting replacement of the irregular patterning cathode ray tube. Bitzer was responsible for the creation of PLATO. But more than that, his genius and optimism were often forces that allowed a seemingly anarchial operation to continue to make progress. Robert Davis, a widely respected math curriculum developer, was principally in charge of the PLATO math curriculum. He put together a team of six authors to work on three strands: graphs, whole numbers and fractions. Gerald Glynn and Don Cohen created the graph lessons. Bonnie Anderson Seiler and Charles Weaver conceptualized the whole numbers strand and the fractions strand was designed by Sharon Dugdale and David Kibby.

From the beginning PLATO math was a multifaceted operation. In 1974 it was implemented in twelve different classrooms in the Champaign-Urbana area. The authors wrote lessons, discussed routing procedures and curriculum problems, evaluated lessons, talked to teachers, oriented teachers and observers and wrote more lessons. Others developed additional hardware, routed lessons, talked to the authors

and maintained the system. It was difficult even for the staff to keep up with all that was happening. There were teacher meetings; staff meetings; visits from experts in curriculum and experts of hardware. There were visitors from Japan, from Germany, from Sweden and many other countries. There were calls for help from teachers: "Touch panels aren't working," "The system is down," "The lessons are all mixed up," "The air conditioner isn't working," "Sally can't access her lessons," "The keyset won't type."

When a call came in, typically an author would take it, discuss the problem with the teacher and sometimes rush out to the school. Teachers and authors usually felt that they couldn't wait for Tony, the general repairman. Ties between the authors and the teachers were close--no doubt at a cost to the production quota.

The operation was fluid. If a problem arose in the cirruculum, something was changed. If authors didn't like the way a lesson was working for children they changed it. If teachers pointed out that children needed more help, the authors went back and developed more assistance. If the patches had shown it would have been the craziest of crazy quilts.

The Whole Numbers Strand

Bonnie and Charles became known as "the whole numbers people." They wrote the Whole Numbers Strand. They liked to think of the children as a resource for ideas. They tried to develop curricula that would bring out the children's own ideas, creativity and

flexibility. Lessons were based on the logical organization of mathematics and attention was given to the ways that children perceive and use numbers. Lessons were designed to allow the child to try different ways of working problems, such as: WAYS TO MULTIPLY (Whole Numbers, D18). Children were challenged to think of many ways to find answers. The techniques used to solve multiplication problems were: building up, breaking up (distributing one factor), using the numberline, and applying the standard algorithm. There was also the option to do it "YOUR WAY" (Whole Numbers, F14). Games that Bonnie and Charles wrote to teach multiplication, division, addition and subtraction regularly held a child's interest. It seemed reasonable to argue that the students found pleasure in the repetition of the games. Some of the whole number programming allowed pupils to go over and over a lesson if they desired, or on to more difficult problems. The choice was theirs. Charles also taught some children to use PLATO to produce their own lessons on the terminal. These children were given "author codes."

Critics of the whole number strand argued that the children were given too much freedom, so that learning sequences were often not optimal. Defenders of the strand tended to argue that, for most fourth, fifth, and sixth graders, whole number arithmetic is review, not new learning. The goal was to deepen the child's conceptual understanding and to improve his computational ability. For this kind of learning, it is important to enlist the child's cooperation in selecting topics for further study.

correct name for today's date, but someone has used it already. Please try to make up a new name that no one has used." Children are led to greater originality, including 22 + (1/2 x 0) or even $3^3 - 6 + 2^0$.

Bob Davis and the other authors envisioned PLATO as an instrument for in-service teacher training. Don and Jerry visited the classrooms frequently and helped children as they worked at the terminals. They helped Shelia Hamilton with her responsibilities to PLATO instruction. The first year, Sheila depended particularly upon Don and Jerry with the Graph Strand. She had little experience teaching graphs. Not only were the PLATO terminals new to her, but so were key ideas in the course materials. She did not really have time to learn in advance. "The first day Don was here, I spent two hours on PLATO. Then I bogged down with the organization of the classroom." Sheila Hamilton was quick to admit she had much to learn from the graph strand. With the help from Don and Jerry, she learned it while she organized the classroom and as she taught it.

The Fractions Strand

Sharon and David, the fractions people, took a different approach to the lesson development in fractions. Since the concept of fractions is difficult for most teachers to teach, Sharon and David set out to make doubly sure that children could learn fractions by themselves. They programmed the lessons so as to insure success to the persistent learner. Lessons were so thoroughly programmed, step

by step, that at times the children would say, "I know that, let me go on, PLATO." The authors responded by making it known to the student that he/she could SHIFT out of the lesson at anytime.

They also programmed PLATO to inform the student of their progress in fractions according to level of performance in the sequence. Ms. Hamilton was quite favorably impressed with the fractions strand. Her preference was to finish one learning concept before going on to another. With fractions the programming was elegant in its simple but minute progressive-approximation to the goals.

The Three Strands

The three pairs of authors presented a favorable impression. The different approaches added to the strength of the mathematics curriculum on PLATO. Because the differences in the three strands were at times reflected in the directions to the children, it created some confusion for the children, but it was, I think, outweighed by the flexibility it helped develop in children. It challenged them to think differently in different situations. Not all children can handle the same amount of ambiguity, however. I liked the sense of creativity and meeting of the unexpected of the different approaches.

Teachers' ideas and suggestions were paid attention to by the authors. In the first year this was especially apparent, when problems of breakdown were a common occurrence, and the authors frequented the PLATO classrooms. The second year it was suggested to the developers by the Educational Testing Service that it would be difficult

to measure the effects of PLATO if the authors too were teaching children and the teachers. The CERL people tried to stay out of the classrooms as much as possible. This was especially difficult for people like Don and Jerry who liked to think of the children as a resource for their ideas. Since the Graph Strand was completed, Jerry and Don were asked to let it run by itself. Jerry and Don are not the kind of people who ever find that all is complete. They continued to find new ways of doing things and new ways to help children learn about Math. The combination of development and implementation was a difficult one to accomplish, but the dynamics of such an operation couldn't be matched in a well organized and quiet atmosphere for writing curriculum. The authors were constantly being reminded of the real work of teachers and children, to say nothing of evaluators trailing them around observing what was going on.

The authors seemed to be in tune with children's thinking. The materials were evaluated as the children used them. The fractions people paid more attention to teachers than the whole numbers and graphs people. There was only so much time and children were uppermost in the minds of the graphs and whole numbers developers. This is not to say that the fractions people didn't pay attention to children. They did but more through the teachers than the other two pairs of authors.

Bob Davis set the stage for concern for teachers and children. The teacher meetings served to determine what teachers thought and wanted; not to tell teachers what to do.

Space was provided in PLATO for the teachers to write notes and receive them. Authors read the notes and responded to them. The communication between the teachers and the authors was not perfect but PLATO provided one more avenue to keep in touch. Teachers read notes from and wrote to children and CERL. CERL people read notes from and wrote to children and teachers. Children read notes from and wrote to PLATO, to CERL and sometimes to the teacher.

This study focused on one classroom, and one teacher over two years time. The teacher and the children in the classroom will be discussed in relation to the PLATO terminals and learning in mathematics. It is hoped that the reader will be able to visualize and interpret some of the culture of the PLATO classroom. The observations were focused on three children and their teacher as they met PLATO and learned mathematics. Findings in other classrooms were somewhat different depending upon the teacher and the children.

The complexities of even one classroom cannot be fully described, but it is my hope that the vignettes presented will portray for the reader a part of those complexities as PLATO math was implemented in the classroom.

STUDENT ENGAGEMENT WITH PLATO
ON TASK EVERY SESSION EVERY DAY

Kathy giggled as she dropped an egg on a man's head. Erica bragged, "I hit him." Kathy and Erica were using negative and positive numbers on a number line to position a helicopter to drop the eggs. They could use the same coordinates to position an umbrella to save the man from the helicopter's egg drop.

The scene was a busy one when children worked at the PLATO terminals. They were fully engaged. PLATO combined: a new and interesting machine, an opportunity to carry on a dialogue, immediate feedback, a personalized curriculum, for the most part appropriate to and challenging for the individual child. The tasks were often cast in interesting "fun" forms. It was a combination that motivated children to interact and to remain caught up in a long sequence of PLATO lessons. Attention span was regularly held the full 30 minutes on the terminal.

Children began by learning the procedures for signing in at the terminal. Ms. Hamilton said the first two days of orienting and scheduling the children were hectic. There was a big problem in how to access the lessons. She had explained how to do it but the children hadn't listened carefully. She urged them, "Try it, push it, see what happens." The children were afraid to touch PLATO, afraid they'd do the wrong thing. Ms. Hamilton said, "But the children soon learned that PLATO wouldn't bark or snap their fingers off." A few sessions later, the children sat right down, typed their name, teacher's name and password. It happened so quickly that an

observer had to be very alert to know what lesson the child had accessed, what the directions were and just what the child was doing. The children were so engaged that they didn't want to take time to explain it.

Ms. Hamilton's reports and observations indicated that children did not willingly miss a chance to be on PLATO. For example, on the day of the class Wizard of Oz performance the children continued to finish their sessions on PLATO. When all lessons were abandoned for costuming and preparation for the performance Debbie sat down in her tutu and began TRY THESE: FRACTIONS AND MIXED NUMBERS (Fractions, B16). She was on level 4 of 5. A cowardly lion and a witch were among those who gathered round the terminals and watched Debbie play games and work lessons. The onlookers offered suggestions on how to win in BATTLESHIP (Graphs, 1b). Meanwhile Ms. Hamilton painted Aunt Em's face; Shelly and Rhoda attended to the cocker spaniel who was playing the part of Toto; and other children milled about quietly talking and dressing for the play.

Children by then had been using PLATO for six months. They continued to be fascinated and involved with the tasks on it, even in these extraordinary circumstances. Ms. Hamilton encouraged children to be actively engaged in all their activities in any part of the classroom. It was easier to accomplish at the PLATO terminals. The interviews with Ms. Hamilton, classroom observations and Teacher's Log substantiate this claim. Ms. Hamilton said, "The children really concentrate on the lessons while at the terminal. They often were

so engaged that they would not talk to other children or me while they were working." She said, "It was one half hour of the day when I knew each child was being instructed." Other teachers who used PLATO also testified to the power of PLATO to help keep children on task.

Children were involved not just at the outset but during most of the 30 minute session. It usually was 30 minutes of study time. It is often not the case for children to be on task more than 50% of the time in many classrooms (Tikunoff and Berliner, 1975; Wiley, 1976).

Recently educational researchers have argued and presented data to support the theory that there is a direct relationship between achievement level and "time on task." Teachers report problems of motivation and lack of attention as major stumbling blocks to children's achievement. In 1974-75, the pilot year for PLATO, there were many children in Ms. Hamilton's room who would not attend to tasks. She reported that at the beginning of the year they only worked if the assignments had to be completed before they could go out for recess. However, children who attended to no other lessons in the classroom were usually fully engaged when working on PLATO. In 1975-76, the second year of PLATO, there were a number of children who were not motivated toward school achievement. Ted was an example of a child who was not interested in ordinary school tasks. He wandered about the room and didn't work, and even cried and stamped his feet when asked to finish assignments. At the PLATO terminal he was consistently attentive to the tasks.

Ms. Hamilton had Sara sit beside her so she could monitor Sara's work in regular math, or Sara wouldn't finish it. On PLATO, Sara was guided through her sixes and other lessons. Ms. Hamilton didn't need to monitor PLATO lessons. Kate was not always attentive on PLATO, but she was more engaged there than with other tasks available to her.

The stories of individual children Sara, Kate and Ted presented here illustrate the nature of students' "engagement." These three children were in many ways different. But the three reacted to PLATO with much the same intensity. Kate's engagement was not as complete as the other two, but in relation to her involvement in ordinary school tasks it was clearly at a higher level.

SARA
WHO DIDN'T KNOW HER SIXES AND DIDN'T WANT TO DO THEM

The story of Sara, who did not know her "sixes" and who did not want to do them, turned out to be a mathematics success story. She advanced from level 4 to level 8 on the CTBS[1] tests in seven months. Her attitude may have changed that many levels too.

August 26-29, 1975

The first note on Sara in Ms. Hamilton's log:

> Sara--Quiet, pleasant, cooperative. She was placed in my room two days after school started. I am not sure why. Perhaps because of PLATO (or maybe because her mother's name and mine are exactly the same). Average worker.

Later I found that she had been placed in Ms. Hamilton's room to separate her from a very good friend. It was decided that Sara and her friend spent too much time "cutting up" together. She was sorry to leave her friend but happy to have PLATO. Sara had had an occasion to use PLATO at another school when her mother--a substitute teacher--taught in a room with terminals.

October 15

The children and Ms. Hamilton were having a quiet reading time in their favorite spots. After an hour of reading the children gave book reports. Sara was first to report. She seemed to lack confidence, to be a bit nervous, as quickly and quietly she read.

After other book reports Ms. Hamilton conducted a math lesson. Together, Ms. Hamilton and the children worked problems, such as $\frac{12}{x6}$

[1]Comprehensive Tests of Basic Skills, published by CTB/McGraw-Hill, Del Monte Research Park, Monterey, California 93940.

and x^{14}_{9}, on the chalk board. Sara seemed to be attentive but did not offer answers.

Ms. Hamilton had suggested that I observe Sara. Sara was an average worker in math and had average ability. At that time her attitude toward math was unknown to us.

October 23

Ms. Hamilton was orienting her pupils to the terminals. They had been turned on for the first time that morning.

Ms. Hamilton told them about the password. She encouraged them to keep it a secret. She told them to select a name that was not easy to guess, but something they could easily remember. She suggested they choose a word they liked, perhaps their Mother's or Father's name. Then she wrote on the board:

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SARA S.     NEXT
HAML        SHIFT STOP
PASSWORD
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She went on to explain the procedure. She said HAML stands for Hamilton. She told the children that this morning they would be asked to write their password two times in order to check the accuracy. (The computer did this automatically whenever a user selected a new password.)

Sara asked if they should tell Ms. Hamilton their passwords. Ms. Hamilton said, "you don't need to. Just keep it to yourself." Another child asked if it could be a number. Ms. Hamilton said is just had to be something they could remember.

October 28, 29

(The story of Sara on October 28 and 29 was reported on an earlier page but is repeated here.)

October 28, 1975 (Afternoon)

One of PLATO's problems was with its "extended core storage." Everybody called it "ECS." Terminals were generally used in the afternoon more than in the morning. When all the computer's core storage was in use new arrivals might not be able to access the lesson they needed. Before PLATO could make a lesson available to a student, the lesson had to be moved from the computer's disc memory (which represented a kind of vast storehouse of computer-programmed lessons), into the extended core storage, a smaller but more accessible portion of computer memory. But if ECS was filled with lessons for students who were already signed on, a newly-arriving student might not be able to get the specific lesson that he or she needed. In such a case the student just had to keep trying until some ECS opened up for them. (This was very much like getting a busy signal on the telephone, and having to re-dial a moment or two later on.)

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in fact the correct remedy for a different problem; in the present case it could not have helped.) Sara tried every approach a couple of times methodically.

Sara was relaxed and calm to begin with, but became a bit frustrated when PLATO did not respond to her attempts to access a lesson. She hit the keys harder and said, "PLATO, you're wasting my time."

After several minutes of waiting, then checking, she went to her desk and brought a Language workbook back to the terminal. She worked in the workbook as she sat waiting for PLATO to become less busy. She was learning the limitations of technology.

October 29, 1975 (Morning)

Since Sara had missed her PLATO turn the day before she was one of the first to be "on" the next morning. Ms. Hamilton was diligent in her effort to see that PLATO time was shared in an equitable manner.

Sara smiled as she worked. She did a CHECK-UP ON ADDITION (Whole Numbers, B12).[2] She had no trouble following directions or working the problems. Sara typed slowly. She read the directions slowly and carefully as she worked. Her second lesson was RUBBER STAMP (Whole Numbers, D1). Again she advanced through the lesson with no trouble.

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[2]The description of lessons in the three Math Strands are in the publications Description of Graphing Strand Lessons by Donald Cohen and Gerald Glynn, Computer-Based Education Research Laboratory, University of Illinois, Urbana, Illinois, June, 1974; Description of PLATO Whole Number Arithmetic Lessons by Bonnie Anderson Seiler and Charles S. Weaver, Computer-Based Education Research Laboratory, University of Illinois, Urbana, Illinois, June, 1976; The Fractions Curriculum--PLATO Elementary School Mathematics Project by David Kibby and Sharon Dugdale, Computer-Based Education Research Laboratory, University of Illinois, Urbana, Illinois, March, 1975.

Her third lesson was PARKING LOT (Whole Numbers, D26). Sara finished the "fives" easily, PLATO informed her that she was ready for the "sixes." Sara turned to me and said, "I don't know the sixes and I don't want to do them." I knew that most children her age were working on the sixes so I asked her if she didn't want to try them. She said she did not want to.

Not listening, PLATO presented her next problem: 5 X 6. Sara worked it even though she had said she wasn't going to. Her answer was correct. She clapped her hands and seemed happy with herself.

The authors of the lessons had structured them in such a way that most children continued to be successful, but at the same time, challenged rather than bored. In this instance Sara was afraid to try to multiply by 6. PLATO presented 5 X 6 and since Sara knew the 5's she worked the problem; was successful, happy and confident at least for the moment. The lessons were structured so that sequencing provided logical direction for the child. At the same time that Sara was saying that she wouldn't do the 6's, PLATO continued to present the lesson and hold her attention. Sara was helped past the threatening situation. PLATO managed to create a positive situation out of a potentially negative one. While this did not always occur with PLATO, from observation it appeared to be a most common case.

Sara then chose SPEEDWAY (Whole Numbers, B1) from the game slot. She read the directions aloud to herself as she worked at the terminal. Kathy, who sat next to Sara, bragged to Sara about how fast she was working. Sara looked over at Kathy's terminal and asked Kathy which

race to do on SPEEDWAY. Kathy said, "Do GRAND PRIX." Sara chose GRAND PRIX. Kathy and she discussed the game. Sara entered herself as "RACER" and named her opponent, "SLOW POKE." RACER worked hard to win. She missed 4 X 1. She got it right on the second try. When PLATO took time-out to say, "Great, you got it right this time," Sara said, "OK, OK," indicating "Let's get on with the race--I don't need to be told I'm right."

November 10

Ms. Hamilton encouraged all parents to come to school to observe their children at the terminals. Sara's mother was visiting to observe Sara at the terminal. Since space was limited around the terminal the lesson wasn't recorded. Sara seemed happy to show her mother what she could do and her mother smiled as she attentively listened to and observed Sara.

November 10-14

> Teacher's log: Sara and Ann are doing especially well in SPEEDWAY (Whole Numbers, B1). Bob is faster, but makes more errors. All three are doing multiplication and mixed functions. Sara along with a few others is having trouble with EGG FACTORY--WITHOUT THE HEN (Whole Numbers, D29).

Ms. Hamilton and the children had been discussing equations such as $2 \times 3 + 4 \times 1 + 2 \times 5 = ?$ Ms. Hamilton thought the equation should be written: $(2 \times 3) + (4 \times 1) + (2 \times 5) = ?$ She said the children had no difficulty with brackets, and it was much clearer. The previous year her pupils had frequently used equations such as

(4 x 2) - 3 = 5 and 4 x (3 - 2) = 4 without confusion in HOW THE WEST WAS WON (Whole Numbers, F5). But they found equations confusing when written without brackets.

November 14

The PLATO data showed Sara needing help with EGG FACTORY--WITHOUT THE HEN and PARKING LOT. Ms. Hamilton sat down at the terminal with the children who were listed in the data as having trouble, and worked on their difficulties with them.

November 19

Sara finished the first chapter on whole numbers this week along with 13 other children.

She worked at the terminal on SUBTRACTION CHECK-UP (Whole Numbers, C2). Sara used her fingers to draw imaginary numbers on the screen and answered 4 out of 5 problems correctly. REAL LIFE SUBTRACTION STORY PROBLEMS (Whole Numbers, C1) was next. She read the first problem to herself and worked. She turned and said, "I got 50 points for the open sentence." Sara was correct on 8 out of 8 story problems. PLATO AND YOU (Whole Numbers, A1) was her next lesson. As the picture of a terminal and a boy appeared on the screen she said to PLATO, "I'm not a boy, PLATO," She read to herself and said, "Hi ya!" She read the question which asked for the location of the terminal and chose, "Bonnie's answer." She typed the answer and said, "Bonnie sends me notes and she knows."

Bonnie, one of the authors wrote notes to some of the children in the class. Sara looked forward to those notes. She liked Bonnie.

In a PLATO note at the end of the session Sara expressed disappointment that Bonnie hadn't responded to her.

Sara's next lesson was MAIL BOX (Whole Numbers, G4), a skip counting lesson (counting by 2's, 3's, etc.).

The MAIL BOX lesson excited Sara. Other children had been talking about it. She said, "Oh goody, I get to see the band director!" Kathy, next to her, said, "you get to see the band." They were excited about this lesson. Kathy and Sara counted 13 steps together.

Sara was shown a choice page and asked another friend "which one of these have you tried?" "How about MAIL BOX? said the friend. Sara said "OK, I know how to do it," referring to counting backwards by 10. As Sara counted she took some candy out of her pocket and ate it. She noticed that Kathy on the terminal next to her needed help in changing a sentence in a PLATO note. Sara told Kathy, "Press LAB, then you can change." Kathy corrected her mistake by pressing LAB and retyping the line.

Sara then chose EGG DROPPER (Graphs, 2b) from the game slot. She asked Kathy how to play it. Kathy said, "It's more fun to drop the egg on the man."

The lights went out in the room. The kids at the terminals said, "ohh" and "ahh"--"see how nice it is." The PLATO screen was much more visible when the room was darkened. The student teacher was showing slides and had pulled the shades.

Kathy didn't want to leave the terminal at the end of her session so Sara typed on another terminal to try to find a lesson for Kathy. She couldn't get into more lessons that day.

At the end of the session Sara wrote a note on PLATO:

> BONNIE I AM GETTING MAD WHY AREN'T YOU SENDING ME ANY MORE LETTERS. ARE YOU SICK BUT IF YOU ARE, GET WELL SOON PLEASE ASK SOMEBODY TO WRITE A NOTE TO ME I AM GETTING LONELY I LIKED MY LESSON TO SINCERELY.

(Sara erased the last line when she couldn't add her name and typed "SINCERELY SARA.") Then she changed the first line to "I AM GETTING MADE, WHY AREN'T YOU SENDING ME," and changed the second line to "ANYMORE NOTES. ARE YOU SICK."

Sara was interested in another little girl who was signing into PLATO and while she watched the process, PLATO signed Sara out. PLATO was programmed to sign a child out if the child forgot to do so or stopped working for some reason. Sara started over and was allowed to write her note again. Her session was 38 minutes long.

Children often became interested in their neighbor's lessons. They watched them and worked together. In this instance Sara helped Kathy learn to write a note on PLATO.

November 19

> Teacher's log: I intend to keep PLATO a part of my math program rather than a "do-what-you-want extra." With my reinforcing PLATO activities, PLATO reinforcing basic facts and computation, I feel that a better job will result.

December 1-5

> Teacher's log: Ann, Sara and Lizzie have finished the second chapter of whole numbers. I have noticed that especially Ann and Lizzie prefer doing lessons to games. Sara likes games but getting ahead has become more important. Her reading work habits are good, but it takes a lot of prodding to get math paper work completed. We have started a gift project--felt banners with designs of quilted spaghetti and other pastas. There are 3 pattern choices: 3 wise men, Christmas tree or a messiah. This week those who are completing assignments in a reasonable length of time (according to ability effort) are starting first. Others will start next week. John, Holly and Sara were the first to start their projects.

January 5-9, 1976

> Teacher's log: No PLATO this week. My how we miss it! The room seems so quiet and dull. In regular math we started long division. I put the whole class together for instruction. We will start with very simple problems such as: $4\overline{)844}$. I insist that they do all of the steps, even though the problems are so simple that they can be done easily in their heads. We go over and over: divide, multiply, subtract, bring down until it is automatic.

Sara was not one listed as having difficulty with long division.

January 8, 1976

In an interview Sara said that she missed PLATO when it was off. She said, "It's games that I like and also the things PLATO writes on top." "I was playing on PLATO at another school before I started at Johnson. At Johnson we had to do all the Math tests first." (Referring to the ETS evaluation tests) "Children at Peterson school had done the tests so," Sara said, "they got to play on it." She said, "my mother was substituting at Peterson so she let the kids play on it."

Sara said she likes doing games, especially HOW THE WEST WAS WON (Whole Numbers, F5). "In games there is always some fun. It's just fun math. The main slot is just math and it makes you work harder. In math you have to get the right answer in one or two times, otherwise they take you out of the problem. In games if you get a wrong answer or something you can just keep on going. Like in HOW THE WEST WAS WON, if somebody put in the wrong answer for you, you can just go on. When I play with somebody, they sometimes put in the wrong answer before I could put in the right answer. Like if I pick 12 and they put 13, or 14 or something. I've won once or twice in HOW THE WEST WAS WON, but in HOP GAME (Whole Numbers, B14) I always win against PLATO and against a friend. Me and Ted played HOW THE WEST WAS WON and are always playing short games. Ted and I won 2 games each. First I won, then the 2nd game we tied and the last Ted won. I learn most from the math part on PLATO. I learn more from PLATO than from my teacher cause she teaches off the board and PLATO is like a board. An when you press the things that's a help. Like you just have to press things and you don't have to go up to the board." Sara thinks she learns some math better with her teacher and some better on PLATO. "Like long division from Ms. Hamilton and the rest like addition and subtraction I get better on in PLATO."

"There's one game I really didn't like. I couldn't figure out this one problem. I knew it was right and I couldn't get out. I pressed SHIFT HELP. I knew the answer was right and PLATO said I

was wrong. I try not to get that game anymore and if I do, I press SHIFT-HELP and get out of it."

"I just use the board near the PLATO terminal to make sure it's right (refers to answers to problems). It it's not right I just erase on PLATO and put in the right answer." Pupils sometimes multiplied, divided etc. on the chalk board and then entered their answer on the terminal.

"Ms. Hamilton says you have to do your work before you can do PLATO. Some people were fooling around on the board when they were supposed to be on PLATO--they weren't doing the right thing. They'd do the wrong answer twice to get out and then go on to games. They weren't doing the right thing. Like it's to learn out of, not to play. But the games part is math too 'cept that it's fun."

I asked Sara to characterize PLATO as an animal. She said: "It would be a talking animal. It would be an Armadillo cause like it has hard skin. Like Armadillos you can lift and like PLATO I can lift--an armadillo is talking and it's friendly. PLATO is friendly even though it does sometimes say your answer's wrong, but that's not what I would call mean. PLATO is just fun. I was in Miss Beeman's class and I had to get transferred cause me and my friend couldn't be together. It was worth it to get transferred to have PLATO cause my friend always got me in trouble. We had 3 friends and we're all in different rooms now. Buffy says she doesn't like Beeman (for a teacher) cause they're in these groups too long. They go to different stations art, science, . . . I like everything in my room. I

don't like PLATO being off. My mom said, 'what did you do on PLATO today' and I said, 'well it's off, they're working on it,' and she said, 'oh, that's too bad.' I said, 'yeah.'"

January 12-16

> Teacher's log: We had some parent visitors this week. Sara's mother. It seems that after one parent visits the children must go home and say "when are you going to come?" As the next day or so we always have a couple more. All parents are still very positive and appreciative. No school Thursday. Martin Luther King Jr. Day.

January 19-23

> Teacher's log: The children have become very independent in the PLATO sessions. They rarely ask for any type of help and have developed self confidence that they can figure it out. Recent visitors have reminded me of something I had taken more or less for granted--the speed of typing and skim reading the children do. When parents visit, they are always surprised at how quickly the children skim familiar material and understand directions. The parents will comment that they have read only half the page and their child has pressed "Next" and knows exactly what to do. I can see that this is carrying over to assigned reading. The Magic Word group, in particular, had great difficulty understanding directions in the fall. We spent weeks and weeks talking about simple directions and comprehension. Their progress is very good. I feel much of this is due to their PLATO experience.

January 26

Sara was one of 4 youngsters (out of 24) recommended to be placed in a review version of Fractions after ETS Check-up B was given.

January 26-30

> Teacher's log: Sara was one of many children to receive an extra session on PLATO for passing fact challenges during the second grading period. The children were delighted with a coupon "good for 1 extra PLATO session." They preferred it to a foreign coin as a reward.

January 29

> Teacher's log: We started fractions this week. Last year I did classroom fractions 2 or 3 weeks before the children used it on PLATO. I decided to let PLATO do the introduction this year. We seem to be off to a very good start.

January 30, 1976

PLATO data says Sara is ready for Meanings worksheets (Meanings 1 thru 10). The worksheets referred to here were prepared by CERL to augment the PLATO lessons.

The following data is an example of the kinds of information available to the teacher on the PLATO terminal. Sheila referred to the data often to keep track of children's progress and to plan extra help lessons.

In Whole Numbers PLATO data

Symbol explanation:

- \+ fine
- ✓ satisfactory
- \- unsatisfactory
- T terminated
- C continuing
- L leaving
- F fast state

Data on Sara

Subtraction

add concepts	+ and C
sub concepts	+ and C
facts concepts	+ and C
skip counting	+ and C
add - algorithm	✓
sub - algorithm	+
add computation	no entry
sub computation	no entry

Multiplication

concepts	+ C
facts	+ C
repeated add	C
arrays	✓
building up	no entry
doubling	no entry
breaking up	no entry
number line	no entry
algorithm	+
computation	no entry
factors	no entry

Division

concepts	+ C
facts	✓ C
repeated side	no entry
number line	no entry
sharing	no entry
guessing mult	no entry
algorithm	no entry
computation	no entry

General

place value	+
T - F equation	no entry
word problems	+ C
comp. 2/two oper.	- C

Ms. Hamilton asked how they would find 3/5 of 25. Sara suggested you draw 25 x's and Rhoda said the x's should be in rows to make it easier. They continued in this manner.

Ms. Hamilton told the children who were on terminals to remember to SHIFT NEXT to back out, and get ready for slides of Venezuela.

February 5

Sara is one of 9 children who have reached the PIZZA lessons and are doing well. Sara had a + on MEANINGS OF FRACTIONS (Fractions, A12) and was continuing MIXED NUMBERS AND FRACTIONS. She had +'s on CUT AND PAINT (Fractions, A5), LIGHTS (Fractions, A10), CHECK-UP FOR MEANING OF FRACTIONS (Fractions, A12) and PIZZA FRACTIONS (Fractions, B4).

February 9-13

> Teacher's log: This is something that bothers me about this year's program. I want them to concentrate on fractions, but when they sign on they immediately have options--some of which are not fractions. I can't be there every time someone signs in to make sure they go into fractions--I lose control over what they are doing. The game slot options are fine (if adequate instruction is available) BUT NOT LESSONS.
>
> Sara is doing very well along with Kathy, Rhoda, Ann and Lizzie.
>
> There was an interesting class reaction to PLATO related worksheets: long-faces and groans. But when they got the "meanings" worksheets and started to do them they really enjoyed them and were ready for more. It was a quick and radical change in attitude. I'm glad the first group was so clever and humorous as it really started them out right.

February 13

Sara was doing CHECK-UP FOR MEANING OF FRACTIONS (Fractions, A12) with a +. She had a ✓ for MIXED NUMBERS WITH PIZZA (Fractions, B9). She had a + for PIZZA FRACTIONS (Fractions, B4), PIZZA CUTTER STUCK (Fractions, B5), c for 2 PIZZAS FOR 3 KIDS (Fractions, B6), c for MIXED NUMBERS INTRODUCTION (Fractions, B8), + for MAKE-A-MONSTER (Fractions, B14) and for STICKS AND STRINGS (Fractions, B15).

Sara was now ready for the mixed numbers booklet and worksheets produced by the CERL people to accompany PLATO lessons.

In whole numbers Sara was continuing in multiplication factors satisfactorily.

February 16-20

> Teacher's log: Sara has gotten so enthusiastic. Remember, she didn't care too much for math at the beginning of the year. This week she brought visiting grandparents to see her session (Mom and Dad, too). Sara was one who completed mixed numbers. Regular math is all fractions--worksheets of my making and CERL. This will continue for quite a while.

Ms. Hamilton gave a test on meanings of fractions. Sara missed the following problems:

$1/4 \neq 2/4$
$1/4 = 2/8$
$2/4 = 4/8$
$8/9 \neq 9/10$
$1/10 \neq 9/10$

February 20 - Sara's PLATO data:

Ms. Hamilton kept many records of each child's progress. She

used the data on PLATO to help her out. Sara's PLATO data on February 20 included the following information:

Whole numbers

Mult. meaning	✓
Mult. and subtraction techniques	+
Mult. and subtraction techniques	C

Fractions

Meaning of fractions	+
Mixed numbers and fractions	+
Equivalent fractions	C

Sara had + on check up mixed numbers and on check up number line.

Sara missed some problems on the worksheet--mixed numbers and fractions

Sara missed: $5\frac{5}{12} + 5\frac{11}{12}$

She also missed a negative -1/4

February 27

Sara's PLATO data:

PLATO said Sara was ready for mixed numbers booklets and worksheets. In whole numbers she was doing fine and continued in facts.

March 5

Whole numbers--Sara's PLATO data:

Mult. meanings	✓
Mult. and subtraction techniques	+
Mult. and subtraction techniques	C

Fractions

Meanings of fractions	+
Mixed numbers and fractions	C
Equivalent fractions	C

March 8, 1976

Sara was at the PLATO terminal. Sara worked at REVIEW AND PRACTICE[3] and did the problems quickly and accurately. She went right through SORT EQUIVALENT FRACTIONS (Fractions, C13). When she got to SORT EQUIVALENT NUMBERS (Fractions, C15), she had some difficulty but managed to get through with PLATO's help. Sara said she'd had TORPEDO (Fractions, C22) enough so she shifted out of it. She also shifted out of TOWER PUZZLE (Graphs, 4.p).

Ted was sitting next to Sara and helped her make a whale using the 6, 7, 8 and 9 after SHIFT MICRO. Sara was happy to be able to make a whale on PLATO. Beth wanted to play TORPEDO with Sara, so Sara started but her time was up.

March 8-12

Sara helped make scenery for the play since she was one of eight pupils to complete assignments on time. At the beginning of the year she had had to sit by the teacher to work. Sara had completed the equivalent fractions worksheet to complete her assignment. The PLATO data showed nothing new. She was continuing in equivalent fractions and multiplication and subtraction techniques. The children had a couple of days to pass fact challenges: multiplication, division, addition and subtraction facts. Sara was one who completed adding and subtracting fractions and mixed numbers worksheets without having had the lessons on PLATO. She had teacher help. Sara missed reducing

[3]REVIEW AND PRACTICE was the lesson a child was routed to at the beginning of a session. When the child had finished 2 or 3 lessons to a mastery criterion, two or three tasks similar to those in the lessons were presented for review.

fractions. The children who had PLATO made fewer mistakes than those children who hadn't. Sara's mistakes were in reduction of fractions.

March 17, 1976

Sara was at the terminal working happily, confidently and with accuracy on CHECK-UP FOR MIXED NUMBERS AND FRACTIONS (Fractions, B23). She says, "I'm perfect at these, I've never missed one after I learned how to do it." Then she chose SORT EQUIVALENT NUMBERS (Fractions, C15). Bob said to her, "I hate those." Sara responded, "Well so do I, that's why I'm trying to get out of them." Sara told me she was going to finish this lesson before she went on to a game. She was on level 2 of 10. After a few minutes, Sara said, "I'll never finish." She used the blackboard by the terminals to figure out an equivalence of 32/24. She worked SORTING EQUIVALENT NUMBERS for 20 minutes. Then watched Bob play FRACTIONS BASKETBALL (Fractions, E12) which was new to her. Bob did very well at the game. Sara wanted to play TORPEDO but only if she could play a person rather than PLATO. She found an opponent and played for 7 minutes against >>>•> (symbols pupils used to represent themselves).

Sara noted that Erica was not trying to figure out the answers in TRY THESE: EQUIVALENT FRACTIONS (Fractions, C16). "Erica is just writing anything to get out of the lesson." Sara said, "Erica you shouldn't, I'll help you," and she helped Erica understand how to work the problem.

March 26

The PLATO data showed Sara passed CHECK-UP FOR EQUIVALENT FRACTIONS (Fractions, C23). PLATO data indicated she was ready for the addition and subtraction of unlike denominator booklets and worksheets. In Whole Numbers she was doing fine in addition, subtraction, division and multiplication concepts.

March 29

Sara was a challenge winner in division facts (she could answer $6 \div 2$ and $18 \div 9$, etc. faster than other children in the room when flash cards were presented to her) and had passed all addition, subtraction, multiplication and division facts. She received an extra PLATO session for being a winner. Ms. Hamilton used flash cards to check each child on facts through the year. Occasionally she had a contest and children competed to win the tournament.

April 2

PLATO data indicated Sara was doing satisfactorily in DECIMAL NAMES FOR FRACTIONS (Fractions, G5) and FRACTION NAMES FOR DECIMAL NUMBERS (Fractions, G6) and was continuing in SORT NUMBER NAMES WITH DECIMALS (Fractions, G9).

PLATO data indicated Sara to be ready for the MEANING OF DECIMAL FRACTION booklet.

April 5-9

Sara was one of six to work on ADDING AND SUBTRACTING WITH

UNLIKE DENOMINATORS. Out of 6 pages of problems Sara missed only 5 items. She was doing fine on whole numbers and word problems.

April 12-16

Sara was one of four children who completed the ADDING AND SUBTRACTING WITH DIFFERENT DEONOMINATORS booklet. She was doing fine on DECIMAL DARTS (Fractions, G3) and was ready for the MEANING OF DECIMAL FRACTIONS booklet.

> Teacher's log: Sara has really done an outstanding job. It was so difficult to get her to complete any math at the beginning of the year. In fact it was often necessary to have her work near me to accomplish her daily tasks. She really seems to enjoy math now.

April 19

The DECIMAL FRACTION's booklet: Sara was 1 of 8 who completed it. She missed 6 questions, including such problems as:

30 = 3/100
90/30 = 3 3/10
6/20 = 3 3/10

April 23

Sara had a "fine" or "satisfactory" for Chap. I, II, III and VI. There were no data for IV and V. She had "unsatisfactory" on STICKS "N" STRINGS (Fractions, B15) and MAKE-A-MONSTER: COMMON DENOMINATOR (Fractions, C20). She was ready for the MEANING OF DECIMAL FRACTIONS booklet.

May 3-7

Teacher's log: Another set of Sara's grandparents visited.

May 10

Teacher's log: Most children had not done adding and subtracting fractions on PLATO at time tests were given. Sara had done 3 lessons on decimals.

May 17

Sara was relaxed and confident as she worked at the terminal. She told me that she had been waiting for decimal fractions so that she could get into like and unlike fractions. Sara repeated, "That's what I've been waiting for."

Sara worked quickly and accurately as she reviewed CHECK-UP FOR EQUIVALENT FRACTIONS (Fractions, C23). She went on to SORT NUMBER NAMES WITH DECIMALS (Fractions, G9) and had no trouble. Sara didn't look carefully at the DECIMAL DARTS (Fractions, G3) and was confused by the negative numbers for a minute, but she figured them out. Then she went on to CHECK-UP FOR MEANINGS OF DECIMAL FRACTIONS (Fractions, G11) and did very well. She chose the game, FRACTIONS BASKETBALL (Fractions, D7) and asked me to play. Since it was one of my last visits to the room, I accepted. We had a good time. She won.

She had learned a lot of fractions since the time she first tried to sort equivalent fractions.

May 24

On Tuesday after school, those who had earned 800 points during the year for "assuming responsibility" joined Ms. Hamilton and her husband for a round of miniature golf. Sara was one of the eleven honored.

Sara had learned a great deal over the year. She tried things she wasn't sure of (on Oct. 28 she had said, "I don't know my sixes and I don't want to do them.") She wanted to do everything there was on PLATO. She observed what other children were doing and checked her lessons so she would be able to progress to their levels. It seemed to me that Sara always had a competitive spirit. When she wasn't excelling in math, she didn't want any part of it. As she worked on PLATO she began to understand math better, and excelled in it. I believe PLATO provided an opportunity for her to be tutored privately without her having to admit to anyone that she made mistakes. It seemed that she had learned to accept her mistakes more easily as she gained confidence in her ability in math.

Sara was unusual within her class on achievement test gains. Her biggest gains were in concepts and applications, whereas other children moved further in computation.

Ms. Hamilton had said Sara was an above average child in everything but math. Math had been something that Sara didn't care about. Ms. Hamilton had to go over and over math with Sara at the beginning of the year in order for her to understand it, but by the end of the year Sara was quick to understand. As Ms. Hamilton said, "She really blossomed this year."

AN INTERVIEW

May 18

B: I'd like to find out a little bit about what children think about PLATO and what they think about math.

S: Well at the starting, when I was in Kindergarten up to 4th grade, or up to 3rd, I didn't like math.

B: Oh, you didn't?

S: My sister was on PLATO in 2nd grade. I wanted to be in the room with PLATO and I wasn't last year. And then this year I had to be transferred and I was transferred to a room with PLATO and then I started to really like math. I didn't like it before I started on PLATO. Like Ms. Hamilton didn't rush. She didn't go fast.

B: What did she do?

S: Like if you were really bad at multiplication then she'd say mmm - she'd just go back and go on with the other kids and we'd have a review and she'd - we could just do it then and you'd figure it out then. And PLATO you can go ahead and you don't have to wait for everybody else. So - that you might lose what you learn.

B: Um hum. You don't have to wait.

S: Like maybe Bob would be behind in his work and everybody'd have to wait and PLATO - and PLATO you just do your own stuff.

B: What other things do you like about PLATO?

S: It's fun--Well it helps you type. I used to not be able to type and now since PLATO I type my name real fast. I can do it in 5 seconds. And I like the games.

B: You do?

S: And like the games are fun but they also teach you something. Like in HORSE RACE (Whole Numbers, B4).

B: Tell me how.

S: You put in the right number so you have to be thinking.

B: What do you do in HORSE RACE?

S: Well, there's some horses and you pick one of the horses you want and then if you've never done that race before you have a practice. An if you have, you don't have a practice. You go right into it.

B: What kinds of problems are there?

S: Well, Multiplications, Divisions and all kinds--I think it's real fun cause I love horses and I watch every horse race on T.V.

B: Oh you do?

S: I try at least.

B: You know who wins them?

S: The one that won the Preakness is Elocutionist and I know a lot of them. One that won Kentucky Derby was Old Forbes.

B: You say you've learned a lot. What did you learn in multiplication?

S: Well, I can do 25 X 25.

B: OK

S: (writes)

$$\begin{array}{r} {\scriptstyle 2} \\ 25 \\ \times 25 \\ \hline 125 \\ 50 \\ \hline 625 \end{array}$$

Sara said, "5 x 5 is 25, put down 5 carry 2" etc. as she worked, step by step.

B: Can you figure it out another way?

S: You can take 5 x 25 and add 5 of them. (She did that)

125
125
125
125
125

B: How do you make sure it's right?

S: You could check it both ways.

B: Is there a hard problem you can do?

S: 165 x 165-

B: How would you do it?

S: You go on to PLATO and pick a hard problem and work in on PLATO and he'd tell you if you got it right. He'll say "OK" if you were right and then if not you'd do it over and you'd work it.

B: What if you broke up the problem?

S: You would add 165, 165 times. You could do it by 25 or by 15's.

B: Show me how.

S: Uses algorithm

165
x165

Explains each step. 5 x 5 is 25 put down 5 carry 2, take 5 x 6 is 30 + 2 is 32.

B: OK. Try this. 6 x 7 is 42--what would 6 x 14 be?

S: Double 42. So it would be 84.

B: Can you make a number line?

S: Yeah--Do what to what?

B: Up to 10.

S: OK.

B: Can you show me 3 x 3 on the number line?

S: OK you go 3 - 6 - 9 -

B: 17 x 2 is 34

Use that number to find 17 x 7

S: You can find out 5 x 17 and then that equals 85 and then you add 34 under here. It's 119.

B: What is an easy way to find 6 x 14 if 6 x 15 is 90?

S: Take away 6--84.

B: What did you really learn from PLATO?

S: Well, I don't know. I learned fractions and decimals 'cause Ms. Hamilton didn't teach us any and only me and Ted have done HORSE RACE (Whole Numbers, B4).

B: Did you learn to Multiply?

S: Kind of. . .I learned lots from PLATO tests. Kind of. . .Well I don't know--well I learned multiplication. I learned by a 1 digit number and by a 2 digit number.

B: Did you learn addition?

S: I learned lots of addition and subtraction. They gave you a check up. I started at Chapter 1. Now I'm on Chapter 8. I finished it and I was so happy. Chapter 8 is adding and subtraction of mixed numbers. I was so happy to get decimals.

B: What do you learn from the games? Or are they just fun?

S: I don't know, but they wouldn't give you anything unless you learn. I played games with Ben, Mrs. Hamilton, or Leslie. I'd get a friend to play rather than PLATO.

B: Did you ever need help?

S: Yes, I'd go to Mrs. Hamilton for Help or to somebody else. Usually Mrs. Hamilton. If she's doing something and you shouldn't ask, she'll get mad at you.

B: Is PLATO ever wrong?

S: Sometimes maybe, I tell Mrs. Hamilton. I say I'm right and PLATO's wrong. She says PLATO is wrong.

B: What is PLATO?

S: PLATO's a computer. I don't really know.

B: Does PLATO give you many choices?

S: We have a lot of choice. Why do they have those other things on Thursday and Friday? Like JUMPING BEANS (Fractions, A4) and GIMME (Fractions, E5)? We've already learned all that. I don't like it. If you're at Chapter 8 and you get something from Chapter 1 you think, "Oh, Boy, they think I'm doing real bad." If you do real good then you get back and on Monday you're always back again.

B: Do you like PLATO as much now as at the beginning of the year?

S: I like Math because of PLATO and Ms. Hamilton. I like math a whole lot now.

B: What do your parents think of PLATO?

S: I think they think -"I'm glad my kids like to go to school."

My Dad and Mom are glad that I like to go to school--cause before I always said, "Oh only 160 days left." I didn't want to go to school.

B: Do you want to have PLATO next year?

S: I want to go into Mr. Kalisch cause he has PLATO. He's real mean and I hate Mr. Kalisch but I want to have PLATO.

SARA'S NOTES ON PLATO

BONNIE THIS IS MY LAST NOTE TO YOU.
GET SOMEBODY I CAN DEPEND ON TO WRITE TO ME
EVERY DAY.
GOOD-BYE LOVE DUDE

. . . . . TEACHERS RESPONSE FROM BONNIE . . . . .

SORRY, SARA. I MUST HAVE MISSED READING YOUR LAST
QUESTION. WHAT CAN I HELP YOU WITH/

NOTHING BONNIE I WAS JUST GETTING WORRIED ABOUT YOU BECAUSE
I DIDN T GET ANY NOTES FROM YOU
LOVE SARA S
P. S. I THOUGHT YOU WERE SICK.

BONNIE I AM SO HAPPY TO HEAR FROM YOU
I THOUGHT YOU WERE DEAD OR VERY SICK
WRITE TO ME EVERY DAY (AT LEAST TRY)
LOVE SARA S (DUDE)

BONNIE, ARE WE GOING TO HAVE TO START THIS AGIAN
PLEASE DONT. I LIKE YOU VERY MUCH. DO YOU KNOW MY DAD/
HIS NAME IS WILLIAM SANDBERG (OR BILL)
LOVE SARA S

BONNIE DID YOU GET THE NOTE FROM BETH D YESTERDAY/
IT DOESNT SEEM YOU DID
LOVE DUDE
(SARA SANDBERG)

BONNIE HAVE YOU EVER BEEN TO OUR SCHOOL BEFORE /
IF YOU HAVE DID YOU LIKE IT
LOVE DUDE

YES. I USED TO GO TO YOUR SCHOOL A LOT. JOHNSON
SCHOOL IS ONE OF MY FAVORITE SCHOOLS.

DEAR BONNIE, WHICH NAME DO YOU LIKE BETTER /, DUDE,DUDE,OR
LEO /
YOU STILL HAVEN 7T ANSWER THE LETTER WHEN I ASKED IF YOU
KNEW MY DAD PROF. WILLIAM SANDBERG. SARA S

I DON 7T KNOW PROF. WILLIAM SANDBERG. IS HE YOUR FATHER /

DEAR BONNIE,
MY DAD WAS HERE TODAY AND I WISH YOU WOULD OF SENT ME A NOTE THAT TOLD ME IF YOU KNEW HIM OR NOT
WELL. GOOD-BYE FROM BOTH ME AND MY DAD.

I DON 7T THINK I 7VE MET YOUR FATHER, PROF. SANDBERG.
(I WROTE YOU A NOTE ON FRIDAY, BUT PLATO WAS NOT ABLE TO DELIVER IT ON MONDAY.)

TEACHER NOTE FROM KEITH S

PLEASE LET US KNOW IF YOU RECEIVE THESE NOTES.

BONNIE, SHOULD I TELL YOU AND THE MAN THAT WROTE THE TENNY NOTE TO ME TODAY WHEN I DON 7T GET ANY NOTES /
AND ALSO WOULD YOU PLEASE COME TO OUR CLASSROOM AND TALK TO ME ABOUT HOW PLATO WORKS

WE FOUND THAT THERE WAS NOTHING WRONG WITH PLATO 7S MAIL SERVICE ON MONDAY. THE PROBLEM WAS THAT THERE WAS NOT ENOUGH ROOM IN PLATO TO GIVE YOU THE NOTES-READING LESSON. BUT PLATO WOULD HAVE DELIVERED THE NOTE THE NEXT DAY.
(IT 7S LIKE THE MAIL RUSH DURING CHRISTMAS.)

I LIVE IN NEW JERSEY, SARA, BUT NEXT TIME I 7M IN CHAMPAIGN, I 7LL VISIT YOUR CLASS.

DEAR BONNIE,
THERE WAS AN ERROR IN TORPEDO
COULD YOU
FIX PLATO LOVE DUDE (SARA S)

DEAR BONNIE
I WISH I HAD MORE TIME
BYE
SARA S (DUDE)

KATE
WHO LEARNED WHOLE NUMBER FACTS

Kate's mother was worried about her poor progress in mathematics. So was her teacher.

September 4, 1975 (Morning)

The children were working on papers from their folders. They were correcting mistakes that Ms. Hamilton had checked. They were in groups working on their individual folders. Ms. Hamilton sat at a table and called those who had written names on the board asking for help. The student teacher also helped children who had difficulty.

Kate was having trouble with her subtraction. She yelled, "Ebel, I need help." Ms. Hamilton looked up to see where the noise was coming from and said to herself, "Who's saying Ebel?" Ms. Hamilton noted that it was Kate and told her to write her name on the board. (Children were helped by Mr. Ebel or Ms. Hamilton in the order that their names were written on the board.) Holly, who had been trying to help Kate, went to the board and wrote Kate's name on the list. Later Mr. Ebel did help Kate with subtraction. Kate would listen a bit and then look away. She appeared to give up easily, but seemed to understand subtracting with borrowing, when helped. (This first impression proved to be in error. The concept of borrowing continued to be problematic for Kate throughout the year.)

September 23, 1975 (Morning)

Kate spent her time observing other children doing their work.

She did not follow when Ms. Hamilton discussed multiplication with the whole class.

October 1, 1975

The children were finding their places for a quiet reading time. Ms. Hamilton stressed the importance and pleasure of reading by setting aside a special time when she and the children all read. Each child chose a comfortable place to read. Six children had the privilege of reading in the compartments of King Tut's Tomb. Egypt was in evidence around the room: cardboard structures of pyramids, tombs, etc.; colorful artifacts and Egyptian pictures. Other children sat or lay on the window ledge. Some children sat at their desks. Kate tried to find a comfortable place under the terminal. She decided to sit beside the terminal on the floor and there she read.

October 8, 1975

With the children Ms. Hamilton and Mr. Ebel were planning a trip to New Salem and Springfield. Ms. Hamilton was pointing out that the children could earn extra points in good citizenship on the trip. Good conduct on the bus, at the memorials, etc. were ways of getting extra citizenship points for the year. Ms. Hamilton awarded good citizenship certificates to children who accept responsibility. On the trip to Springfield the children had an opportunity to earn 35 extra points. Ms. Hamilton sat with a group of the children around a table as she explained the trip responsibilities. Ms. Hamilton

chose Kate to go to the office with a note. Kate went and came back to join the planning session. Ms. Hamilton explained the sequence of events and the behaviors expected at each stop. Kate paid some attention as Ms. Hamilton talked. She dropped her pencil and looked around under the table for it as the other children listened and discussed.

Children asked Ms. Hamilton what group they would be in. Ms. Hamilton spent 2 hours the night before trying to place children in groups. She tried to place them in a group with one of their top three choices and avoided placing them in groups with children that they preferred not to be with.

Mr. Ebel presented a flow chart to the children on the passage of a law. The children discussed and role played the passage of a law. Kate drew pictures as the other children discussed.

The children went back to role playing and passed a bill, "No Leash Law, and No Cruelty to Animals." Meanwhile Kate took an eraser and went to her desk. She watched the clock and said, "It's time for P.E." She and another boy played with a pencil until they went to the gym to play ball. Kate is a "good catch."

October 1975

In an interview I asked her if she liked to work on math. Kate said in a very quiet way, "I like to do my pluses, take aways, times and borrowing."

B: Would you write down a problem that you like for me?

K: (She writes 2 x 9)

B: What does 2 x 9 equal?

K: 27 (pause) 29

B: 2 x 9 equals 29?

K: 24

B: How do you know it's 24?

K: 17

B: Are two nines equal to 17?

K: 18

B: Kate, do you ever use math when you are at home?

K: I do flash cards. I'm on my 3's.

B: How about when you're working or playing? Do you use numbers then?

K: Sometimes. I read in the car.

B: Are there times when you are playing that you count or add?

K: When I get out of school, I just count on my fingers, and sometimes I think in my mind.

B: What about when you're playing a game? Do you ever use math in playing a game?

K: See my father says I can go out to play and then when I come in, I do my homework. And then, I get to do my math and I take a bath and go to bed. Sometimes he forgets about it, when we go someplace or when I go over to someone's house.

B: OK, do you have any brothers and sisters?

K: I have a brother and my mother's having another baby.

B: How old is your brother?

K: 6 years old.

B: Is that using math when you tell me that you have one brother who's six years old?

K: Nope.

B: Do you ever do cooking?

K: I make Koolaid and stuff and sometimes I cook hot dogs. I know how to make cookies.

B: When you make cookies do you stir up the dough? How much flour do you use?

K: (pause)

B: Do you have a recipe?

K: My mother measures for me.

B: Do you ever go to a store?

K: My mother tells me to go to the store.

B: Do you take money?

K: yep

B: Do you get change?

K: Yes.

B: How can you tell how much change you'll get back?

K: They just tell me.

B: If you bought 6 oranges and each one cost 2¢ how much money would you give the storekeeper?

K: 2¢

B: If you bought 6 and each cost 2¢?

K: (after much thinking) $1.00.

B: A dollar for 6 oranges that cost 2¢ each. I think you'd be paying too much if you paid a $1.00. How much would one cost?

K: 2¢.

B: Alright, if one costs 2¢, how much would 2 cost?

K: 3--no--2

B: If I bought 2 oranges, how much would it cost? I had to give two pennies for one orange. How much would I have to give for 2 oranges?

K: (pause)

B: If I gave the storekeeper 2 pennies for one orange, what would I have to give for two oranges?

K: (pause)

B: Let me show you. Here's one orange and for that one we have to give 2¢ (illustrates on paper). Does that look like 2¢ to you? Now how many cents will I have to give the storekeeper to get two oranges?

K: 2¢

B: I'll have to give them 2¢ for one orange, won't I? Now how many for 2 oranges?

K: (pause)

B: OK, look at it in this way. I want to buy an orange for me and I want to buy an orange for you, right? I'm going to give the storekeeper 2¢ first for an orange for you. So you've got one. Now I want to buy an orange for me. How many cents do I have to give her?

K: two

B: OK, two more, so I gave the storekeeper two and then two more. So how many altogether was that?

K: 4

B: 4--right. That's 4 cents that I gave the storekeeper for two oranges. Now what if I wanted to buy three oranges. How much would it cost? Say you had a friend along and she wanted an orange, too.

K: 3

B: How many cents would I have to give the storekeeper. If there were 3 of us. Instead of two, there were three of us.

K: (pause)

B: We gave the storekeeper 4 cents for two, how many cents for three of us?

K: 6

B: 6, right. Now what if I had a friend and there were 4 of us? How many cents would we have to have?

K: 12

B: There are 4 of us now.

K: 10

B: There are 4 people, so we have 2 cents here (illustrated). That's two. Each one wants an orange. Can you add them up?

K: (pause) 4 (pause) 6, 8.

B: So we'd have to have 8¢ wouldn't we? Alright so now say there's one more friend, so there are 5 of us. Each of us wants an orange.

K: 10

B: OK, now I asked you before if there were six people. How much would it cost for 6 oranges?

K: 12

B: 12, OK. So say we didn't have a dime and two pennies to give the storekeeper, who we'll call Mary, and so I gave her 15¢. I gave her a dime and a nickel. Do you know how many pennies I'd get back?

K: (pause)

B: What if I gave her a dime and a nickel?

K: (pause)

B: How much do the oranges cost?

K: 12

B: 12 cents, so how much would be get back?

K: 10

B: Would we get 10 cents back? If we got a whole dime back, Mary would only have a nickel.

K: 5

B: Mary couldn't give the whole nickel back because she would only have a dime then and she wants 12¢ for the oranges. She would need some pennies. So how many would that be?

K: (pause)

B: How many pennies would she give back?

K: (pause)

B: Do you know how to take away? Wouldn't that be a take away problem?

K: (shakes her head yes)

B: How would you work it?

K: 12 cents then take away 15.

B: Which one are you going to take away, the 15 or the 12?

K: The 12 from the 15.

B: Alright, 15 take away 12 then what would that be? How much left? What is 15 take away 12? Can you work that problem here? (Points to paper)

K: (pause)

B: Are these the kinds of problems you do at home sometimes: 15 take away 12?

K: I can do it with circles?

B: Pardon?

K: I can make it with circles.

B: OK. Fine, you go ahead and make it with circles. That's a good way to do it, isn't it?

K: (pause) 4

B: 4, I think you counted wrong. Let's see 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16. You had 16 there, let's erase one. OK, so what would it be, 15 take away 12.

K: 3

B: Right, OK. So how many pennies would you get back then?

K: 30

B: What, how many? What did you say? I can't hear you. Did you say 30? Would you get 30 back? No, you figured it out right here.

K: 3

B: You only have 3. 15 cents would be the same as 15 pennies and you gave 15 to the lady to pay for the oranges and she gave you 3 back. OK?

K: yep.

B: I saw you playing ball the other day. What was the name of the game you were playing?

K: German dodge ball.

B: German dodge ball. It looked like it was a lot of fun. Now you have something in your room called PLATO. Have you ever been on PLATO? Do you know what PLATO terminals are?

K: Something like a machine, that something that talks to everybody. It helps you do math and stuff.

B: OK.

K: It has games you can play.

B: Do you think you like PLATO?

K: Um Hmmm.

B: Sometime when you're on PLATO, would you show me how it works?

K: yep.

B: Good.

K: I think I've been on the PLATO machines before.

B: You think you have been?

K: Yeah, I have.

B: Oh, really, Was it for reading or for math?

K: Just to play games. The teacher said we could play games, when we're done with work.

B: Oh, good. Do you like to play games?

K: Yep.

B: Do you remember what games you played?

K: This game where there's a cat and a dog and you try to get him to the bone.

B: Was there another game?

K: I forgot.

B: When the terminals are turned on in your room you can show me how.

October 15, 1975

Ms. Hamilton had a "whole group" lesson on multiplication. Kate was slow to find the page in the math text book. She didn't seem to follow. Half way through the lesson, Kate asked to go to the bathroom.

October 28, 1975

This was Kate's second time on the PLATO terminal this year. Ms. Hamilton had oriented the pupils and now they were working alone. When Kate came over to the terminal she said, "I'm lucky, I get to get on PLATO." Kate counted by 1's as she worked on RUBBER STAMP (Whole Numbers, D1). She read the directions and figured out 2 x 8. Kate made 6 five stamps by touching the screen with her finger. She counted the dots on the stamps by 1's and came up with 29. The second try she got 30. When asked to write the corresponding addition problem, she wrote:

6 + 6 = 12 30 + 30 = 90 5 + 510 = 5 + 456 = 3 + 30 =

When asked what she was supposed to do, she said, "There are 30." When asked how she got 30, she talked about 5 pluses etc. When it was suggested that she try "it" (not knowing what "it" was), she said she had tried it before. She then wrote: 5+5+5+5+5+5 = 30. Kate had not tried this sentence before. When she got it right she smiled and laughed. The next problem on the screen was 1/2 x 3/4 =. Kate looked at the problem, and said, "I need help. I don't want to do this." She typed just any number in, guessing over and over. Then she wrote a note, "It was hard to me. I like the stamp part." Kate yelled for Ms. Hamilton but since Ms. Hamilton didn't hear her, she went on to the next lesson on PLATO, HOP GAME (Whole Numbers, B14).

Kate chose to hop her bunny by 2's. She had some trouble and pressed the key indicating a call for a harder game. It was obviously unintentional. When the game was harder she looked around for help and soon shifted out. At the end of the session she forgot to turn her name card over to indicate that she had had her turn on PLATO. She also forgot to remind the next child to come to the terminal. Ms. Hamilton noted this and asked another child to take a turn at the terminal. Kate tried to turn the terminal off when she left. The next child stopped her.

November 10, 1975

Ms. Hamilton taught a lesson multiplication to the whole class. Kate was attentive part of the time.

November 19, 1975

Kate at the terminal.

Kate was playing CLAIM GAME (Whole numbers, D31) at the end of her session on PLATO. She alternately wrote in number after number or sat for a long time and then came up with a number. She talked to herself as she put down a number. It did not appear that she knew what the game was about.

November 24, 1975

Kate was working on the lesson, EGG FACTORY (Whole Numbers, E4). Her estimates of how many eggs she needed to empty the bin were not accurate. She asked a friend, Leslie, how to make 27. Leslie said, "1 x 27." Kate counted the eggs by pointing to each one on the screen. PLATO wrote the sentence 1 x 27, and Kate went to the next crate of eggs. When Kate saw that she had 17 eggs left she wrote 1 x 27, then 1 x 23 and 1 x 21. PLATO told her to write something like 2 x 7. She did and had 3 left. She wrote 1 x 32. She erased several times and started over. Leslie told her to write 1 x 3. She did. Kate's next crate to fill was a crate of 97. She worked the problem and at the end wrote the sentence: 9 x 6 + 5 x 5 + 1 x 9 + 1 x 9 = . She didn't know what number to put in for the answer. Leslie said to her, "How much did you have to begin with Kate?" Kate typed 96. Leslie smiled and said "Right." Kate's next lesson was 2 digit subtraction and she said, "I hate this one." She put in a couple of numbers and said, "I don't want to do this," and tried to back out of the lesson. Kate hit several keys, and finally SHIFT,

stopped out and started over. She was routed into subtraction again, but this time she took the easy problems. She couldn't work them. The next problem was $\begin{array}{r} 38 \\ +67 \\ \hline 163 \end{array}$. PLATO directions said to change the top or bottom number to make the answer correct. Kate looked at it and said, "What they doin?" Ms. Hamilton came over and told me that Kate had worked some of the same kind of problems last week. Ms. Hamilton said that Kate's work depends upon whether she is motivated or not. When motivated she does things that otherwise frustrate her.

January 27, 1976

In an interview regarding PLATO, Kate said, "I likes math and the games. It's something like HOP GAME. I wins sometimes and is glad, and when I loses I'm mad." When asked what PLATO teaches, she said, "It teaches you how to do dividing and division and stuff." When asked to characterize PLATO as an animal, she thought a bit and said, "A bunny, cause that's my favorite animal."

Kate said, "The worst thing about PLATO is you don't have enough time on it. That's what the whole class say about it. You don't have enough time." When asked what you have to do to be good at PLATO, she said, "To do real good at PLATO you have to know what you're supposed to do and you have to know how to work it and that's all." Kate went back to correcting division problems in her folder.

March 8, 1976

Kate typed fast and touched the touch panel accurately as she worked at the terminal. The touch panel was not working correctly.

She asked for help, but Ms. Hamilton did not hear her. She went to her desk to get paper to figure out 18/9 of a Pizza. She reduced 18/9 to 6/3 and figured that 6 was the right answer. She worked at level 14 and then 15. She didn't get the right answers. Kate said, "Ms. Hamilton, I'm tired of doin' PIZZA" (Fractions, B3). Ms. Hamilton was clear across the room and did not hear her. When she got no help she shifted out of the lesson and tried to play TORPEDO (Fractions, C22). She was very inaccurate in her attempts to win and shifted out of it also.

March 17, 1976

Kate worked on DARTS (Fractions, B22). She was on level 2 of 9. Then she went back to level 1 of 9. She missed the balloon and went on. She didn't read the explanations that came on the screen. Then she tried to estimate where the dart would go by using her fingers. She muddled on a bit and then shifted out. Her next lesson was TORPEDO. She smiled as she made a baby fish for her name. She said to herself, "I can make a baby fish." She looked around to see that all the terminals were occupied, and that the proper names were in the slots to show who was using the terminals. At the first of the year, Kate forgot to turn her name over and remind the next person to go to the terminal. Now she was checking up on everyone. TORPEDO was too hard for Kate to be successful but she played the game a while anyhow. At the end of her session she looked at the data for her session before she left the terminal.

April 13

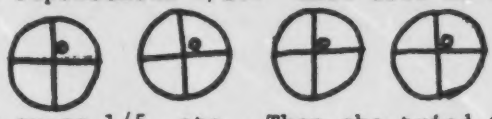
Kate was working on MIXED NUMBERS WITH PIZZA (Fractions, B9) at the terminal. She seemed to understand 28/10 of a pizza, but had trouble converting it to an improper fraction. She was routed to level 16 then 15 and she was still not figuring out the answers. At level 3, she figured out thirds of a pizza. She was routed to level 14 and didn't succeed. She was then routed to 12, 11, 10 to 8 to 6 to 7 to 8 to 7 to 8 to 9 to 7. At this point Kate tried to get out of the lesson but was put back at level 8 to 9 then 7, then 6 to 7 to 8 etc. She had worked for about 25 minutes unsuccessfully when Ms. Hamilton came over to help her. Ms. Hamilton asked Kate what 0/10 means. She asked, "How many parts are there?" Kate said, "0." Ms. Hamilton said "So this means nothing," (pointing to 0/10). Kate went on to have trouble with 12/4 of a pizza. Ms. Hamilton asked Kate to make a picture on the blackboard. Kate illustrated thus:

She said, "the answer is 3." Her time was up and she shifted out. Ms. Hamilton had been asking how Kate was progressing on PLATO, so I alerted her to Kate's difficulty with this fractions lesson.

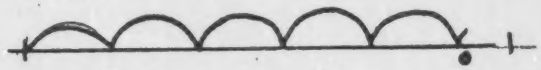
May 17

Kate was at the terminal working on names for 3/4. She tried 1/3, 12 1/4, 1/4 and 2/4. She drew a picture of 9/12 and then wrote 1/9. Kate drew on the blackboard nearby:

She wrote 1/3. Then she tried 1/2, 1/4, 1/5, 1/6, 1/8 and 1/7. She wrote 3/6 and gave up. She watched the other kids. Then she worked on 2/5. Boxes represented 4/10. Kate drew on the board:



She started to guess 1/5, etc. Then she tried to draw more lines on the boxes on the screen of the terminal. She failed to get the lines in the correct places and shifted out. FRACTIONS BASKETBALL (Fractions, E12) was her next choice in the lessons. Kate figured out how many times the ball needed to bounce in order to make a basket. Kate seemed to know which direction to go with positive and negative numbers. She moved her fingers along the line to estimate the bounces.



At the end of the lesson Kate said, "I didn't like the lesson, it was too much boxes. I likes the fractions with little bath tubs." Kate was referring to the lesson PICK A TUB (Fractions, C6).

May 18, 1976

Kate spoke freely and easily about PLATO. "I likes PLATO very much. I likes to draw pictures on PLATO and figure out answers to problems. I likes PLATO because it helps me learn multiplication, subtraction, addition and division. TORPEDO and SPEEDWAY are fun games. I likes games because you can get a friend to play with you." Some friends that she chose to play with were Ted, Erica, Kathy, Leslie and Tom. Kate said, "I likes PLATO better when you gets to choose what you wants to do." She didn't like BATTLESHIP and didn't play it.

In a discussion of multiplication, it seemed that Kate didn't have much of an idea about how to use doubling or breaking up to solve a problem. She did say that 4 x 6 was the same as 6 x 4. Kate did learn to recall her "facts."

In the "Facts Tournament" Kate surprised everyone in the room by winning in competition with Bob, one of the high achieving math students. Her instant-recall was better than his. Winning pleased Kate. She seemed to enjoy telling how she learned to multiply, add, subtract, and divide on PLATO.

Unfortunately, the gap between Kate's recollection of facts and her understanding of concepts was wide. She scored at the same grade level (1.6) in Concepts, on the Comprehensive Test of Basic Skills on April 30, 1976 as she had before on September 5, 1975. In Application during this PLATO year she progressed from 2.7 to 3.2 and in Computation she progressed from 2.8 to grade level 5.7. Her combined score went from 2.1 in September to 4.2 in April in spite of the absence of gain in Concepts.

While test scores tell only a small part of the story, these scores do corroborate the general impressions recorded from the observations of Kate. To recall the addition, subtraction, multiplication and division facts seemed to be Kate's concept of math. Ms. Hamilton felt that teaching Kate the basic facts would be the most beneficial thing that Kate could learn in view of her poor concepts in math. Sheila also noted that Kate could do more on one day than on another depending upon her motivation.

Kate had her own conceptual scheme for understanding mathematics. It was never fully discovered by the adults who tried to teach her. It was not clear that she had an understanding of what the basic facts represented. Perhaps Kate would have benefitted from more experience with concrete materials.

Many PLATO lessons were too difficult for Kate. She quickly spotted lessons she couldn't work at all. She would say, "I need help, I don't want to do this," when a lesson appeared on the PLATO screen that was unintelligible to her. Kate liked working on lessons that stressed the facts. She learned them and her attitude toward math changed. She had no doubt she was learning mathematics.

KATE'S NOTES ON PLATO

DEAR PLATO
KATE N DID NOT HAVE A LONG ANOFF TIME .
KATE N

DEAR BONNIE
I DON,TT

THAT NOT FAIR PLATO

DEAR PLATO
THAT NOT FAIR I PLAYED PIZZA AND I DIDN,T PLAYED GAME
SLOT

TED
WHO GREW SOCIALLY AS WELL AS COGNITIVELY

Ted was described by Ms. Hamilton as one of the most unusual children she had ever encountered. He was placed in the room especially to use PLATO. PLATO had been used by the 3rd grade teacher as a behavior-modification reward for Ted. He had a "work habit problem" and at times, a "behavior problem."

October 8, 1975

Ted wandered about the room and looked out the window for half an hour. Ms. Hamilton said, "I think of everything possible that's positive to say to Ted so that his behavior will improve."

October 15

Ted participated in the group Math lesson. When Ms. Hamilton asked the children to multiply 14 x 7 Ted came up with 141 for an answer. Ms. Hamilton helped the children figure out the correct answer. After the Math lesson, the boys and girls lined up for a break. Ms. Hamilton told Ted that he did a good job of leading the line. Ted said, "Someone ran past me and I didn't even care." When the children were outside playing, Ted was disturbed by kids throwing leaves. Ms. Hamilton told Ted to play away from leaf throwers and told those throwing leaves not to bother people who didn't want to throw leaves.

Ms. Hamilton said Ted is better behaved since she kept him after

school. He had poor work habits. Rather than finish his work he cried and stamped his feed and threw work in the waste basket. Ms. Hamilton warned him that if his work was not done when the time came he would not be going home. She said he put up a big fit--crying, yelling, and throwing things, but he did do his work--and since then has completed his work.

Martin teased Ted. Ms. Hamilton said there are two children in the room Martin doesn't like. Martin was a handsome boy, one who seemed to be very self-assured. Peter, who was very sensitive to Ted's problems, told Ms. Hamilton, "I think you should know that it's not always Ted's fault that he gets in trouble." Peter also responded to him when Ted complained that he didn't like school and didn't have friends, by saying, "You've got one friend, Ted, I'll be your friend."

Ted said to Ms. Hamilton, "The girls won't let me play ball. "Women's lib" has gone too far." The girls said they didn't let him play because he had stolen the ball.

Ted found three children playing a game. He was accepted with no conflict. When the class returned to their room from recess Ted said to Ms. Hamilton, "That was a fun recess." Ms. Hamilton said, "It was your best play time."

October 28 - Interview

When Ted was asked to find 7 x 3, he said, "I should have brought a calculator. How's come it's illegal to bring a calculator?"

B: I don't know, do you?

T: You can't bring a calculator cause that would be cheating in Math. My brother sneaked a calculator into school last year. He didn't get into trouble.

B: What is 35 x 7?

T: (writes)
$$\begin{array}{r} 35 \\ \times 7 \\ \hline 245 \end{array}$$

You can't put 7 x 35 because the biggest number has to be on the top. And the smallest has to be on the bottom. I have to work on my math cause I went on PLATO before I got it done. (Refers to regular math)

B: Do you like PLATO?

T: Yeah--I got to be on 28 minutes the first time. Today I got 33 minutes. The record is 45 minutes by Carl.

B: Is it good to be on long?

T: Yeah, cause you get to play more games. The record was 43 minutes by Ben. Ben got ten lessons. The lowest was Martin. He only got to stay on for 20 minutes. You're supposed to get 30 minutes and he only got 20 minutes. (Note this was early in the school year, before PLATO had good statistical data on the speed of individual children.)

B: Is it better to learn math from PLATO or your regular math class?

T: PLATO's better. I like PLATO a lot cause you get to play a lot of games.

B: What's your favorite?

T: SPEEDWAY (Whole Numbers, B1)--DAYTONA's the best.

B: What do you do on PLATO?

T: Multiply, add, subtract and divide.

B: How about regular Math?

T: You have to do math progress by yourself. We have to do math progress over if someone helps. You can have help with PLATO.

B: Who helps you with PLATO?

T: The teacher or other kids. I have to go back and do my math progress cause I don't want to stay after, or stay in from P.E. (went back to room).

October 29

Ted looked at Illinois, Land of Lincoln as he stood by the window sill. When asked about the book he said, "I'm bored." He then proceeded to relate facts about Illinois such as population, area, Illinois statehood and Lincoln's home, etc. Ted wandered over to the terminals to watch kids on PLATO. Ms. Hamilton tapped his shoulder and said, "Ted, wrong spot." Ted went to his desk to do a work sheet on multiplication. Later Ms. Hamilton said, "Ted," and he quickly went to the terminal to work. Ms. Hamilton used PLATO as a reward. Ted was usually required to finish other work before he was allowed on PLATO.

Ted sat at the terminal and typed his name and password. He leaned over the keys so no one could see him type in his password. Beth, sitting at the terminal next to Ted, said aloud to herself, "Great, I'm a champion adder," as she finished a PLATO lesson.

Ted's first lesson was CHECK-UP ON ADDITION (Whole Numbers, B12). He worked it with no trouble. He said, "This is easy. I can do this simple." The next lesson was RUBBER STAMP (Whole Numbers, D1). He laughed as he touched the screen with his fingers and "stamped." He worked fast with no difficulty. The next lesson was ARRAYS PART I (Whole Numbers, D4). Again Ted had no trouble and talked to PLATO about how simple it was to do. SHUTTLE PUZZLE (Graphs, 4h) came up as a game choice and Ted chose it.

The terminal stopped responding while Ted was playing SHUTTLE PUZZLE. He tried various keys and asked Ms. Hamilton for help. Since Ms. Hamilton was orienting children and helping them with problems, she was sitting next to him helping another child at the terminal. She turned to Ted and turned off his terminal, waited a few minutes and turned it on again. PLATO was ok. Ted said, "I'm glad it works cause I don't want to lose my turn."

CUT AND PAINT (Fractions, A5) was his next choice. The fraction to be painted was too difficult for him and he asked for help. Ms. Hamilton shifted him out. She said she didn't like to have her children getting into fractions when they weren't given instructions. The fractions lesson was a choice for the children in the game slot. She made an announcement to all of the children not to choose CUT AND PAINT and later told the authors to remove the choice from the lessons until fractions were presented with instructions. Ted went on to BATTLESHIP (Graphs, 1b). He said, "I can beat PLATO. PLATO, don't you find my ships." etc. as he played BATTLESHIP. Ms. Hamilton helped

Holly shift out in the middle of a lesson so she could get on after recess. Ted shifted out also and the children went out for recess.

January 8

Ms. Hamilton says she has trouble keeping Ted on task, but not when he's on PLATO. Ted was wandering about the room and when asked what he was thinking, he talked about sports.

B: What do you think of PLATO?

T: PLATO's fun.

B: What's the worst thing about PLATO?

T: When it croaks. When PLATO is off. (The terminals had been off since Christmas vacation for modification of the central computer. One PLATO trouble display showed a frog croaking.)

B: What's best?

T: The games. (Ted told about all the games and how to win at each one. He also remembered the scores for each.)

B: If you were to think of PLATO as an animal what might it be?

T: "Well it's a machine."

B: Could you think of it as an animal?

T: A cat.

B: Why a cat?

T: Because I like cats and I like PLATO.

B: That's a good reason. Do you learn from PLATO?

T: Sure, PLATO teaches by playing games. It's fun but you learn from it.

March 8

Ted said, "It's easier to do math on PLATO sometimes. This is my 70th session." Ted was very fast as he typed in his name and password and accessed the lesson. Ted drew my attention to the note on the terminal that said, "You have a piece of Pizza on your finger." He quickly worked PIZZA: REMEDIAL CUTTER STUCK (Fractions, C9), and moved on to level 9 of 9 in DARTS (Fractions, B22). The next lesson was TRY THESE: FRACTIONS AND MIXED NUMBERS (Fractions, B16). He asked Sara "How do you do TRY THESE?" Sara didn't help him and he went on the SKY WRITING AND SPIDER WEB (Fractions, B12). Ted said, "This is a crazy lesson, you just spin a web all over the place." He leaned over to see Jon enter PLATO and noted that it was Jon's 74th session. Ted said, "You lead me by four sessions." Ted is very conscious of where each child is on PLATO. Ted continued to talk to himself and PLATO as he went into DARTS again. This time there was not enough ECS for him to access DARTS so he went back to PIZZA: REMEDIAL CUTTER STUCK. Ted said, "I want something different." He chose TORPEDO (Fractions, C22) and noted on the screen that Beth was playing. He challenged her to a game and she accepted. Beth won and Ted challenged PLATO. He said, "It's easy to beat PLATO. I beat him twice yesterday." He beat PLATO and played several other children before his turn was up.

Ms. Hamilton had listed on the board the children who had passed mixed numbers on PLATO. Ted was one of them.

April 13

Ted started his lesson with Review and Practice and progressed from level 12 or 13 to 19. Then he went to VOCABULARY: WHOLE NUMBER, FRACTION, MIXED NUMBER (Fractions, B18). Ted said "watch the girl," pointing to the screen. PLATO typed for the girl on the screen. "I don't see why" and "How come." Ted smiled as he marked and said, "Now she knows and she'll put a smiling face on. That's really funny." EQUIVALENT FRACTIONS GENERALIZED (Fractions, C14) was his next lesson. Ted said, "You have to be a fast typer just to do this." He progressed from level 4 to 5 to 6 to 7. Ted said, "I've been using PLATO for a long time. It's pretty fun." He continued on to level 8. He signed and said, "I'm tired." He seemed bored. He missed a name for 3/4. He had been very fast until now. He went a bit slower and said, "I'm on level 10 of 12." When he was on level 11 he said, "Now if I can get here, I can probably pass." He finished 12 of 12 and said, "Oh boy, I finished EQUIVALENT FRACTIONS GENERALIZED." His next lesson was INTRODUCTION TO SIMPLEST TERMS (Fractions, C17). "I want to get through simplest terms," he said. He progressed from level 1 through 7 of 12. TORPEDO was the game he chose. "No one but PLATO!" Ted said as he tried to find a challenger for TORPEDO. He played PLATO and then wrote a note of nonsense syllables. At the end of the syllables he wrote, "DEAR PLATO, YOU ARE A FINK."

May 17

Ted was at the terminal working on SORT EQUIVALENT FRACTIONS

(Fractions, C13). He finished it and asked me to play PICK A TUB (Fractions, C6). Ted was good at PICK A TUB and won the game. FRACTIONS BASKETBALL (Fractions, D7). Ted made some mistakes on FRACTIONS BASKETBALL but worked fast.

May 18

Ted, PLATO and Math

B: Tell me a little bit about PLATO.

T: It's fun

B: What's fun about it?

T: Get to do a lot of stuff.

B: What kind of stuff.

T: I did things like HIGHWIRE (Fractions, E6), GIMME (Fractions, E3), FRACTIONS BASKETBALL (Fractions, D7), HOW THE WEST WAS WON (Whole Numbers, F5).

B: Did you do all of those today? Which did you like best?

T: HIGHWIRE. It's really fun.

B: What is HIGHWIRE anyhow? Can you tell me what it's like.

T: It's about this monkey moving spaces and PLATO does it automatically. And then you have to find out which mood he's gonna be in. The object is you have to tickle the monkey.

B: How do you tickle him?

T: There's this feather and it moves up when you make your move.

B: How do you make your move?

T: You can write either a fraction or a mixed number.

B: I see, what's the object of writing a fraction or a mixed number?

T: You're supposed to write the right fraction, you're supposed to get it.

B: How do you know what the right fraction is?

T: You can count the right fraction and if it sounds easy to you all you have to do is write the right number.

B: I see--are you adding, subtacting or what?

T: Adding and putting--see when they write down the move that the monkey makes you gotta write a fraction or a mixed number and try to tickle the monkey with the feather and the feather moves automatically.

B: Oh, I see. What else do you like about PLATO?

T: It's fun. You can type on--you can erase.

B: Do you ever type notes?

T: Not much.

B: What do you write about?

T: Usually something about what's happened in the lesson.

B: What other math do you do?

T: Sorta like PLATO

B: Why is it like PLATO?

T: You have to take a test to see if you can go on. It becomes harder and harder.

B: Oh it does?

T: On Chapter 1, it was really easy. They had things like SHARE A

CANDY BAR (Fractions, A3), SHARE JUMPING BEANS (Fractions, A14), CUT AND PAINT (Fractions, A5), and PAINTING LIBRARY (Fractions, A8).

B: What do you have now?

T: Since I'm on Chapter 11, the only thing I've passed is DECIMAL DARTS (Fractions, G3).

B: What are the hard things?

T: When I was in level 3, the hardest for me was SORT EQUIVALENT NUMBERS (Fractions, C15). The easiest was SPLASH (Fractions, C7), PICK A TUB (Fractions, C6) and PIZZA: COMMON DENOMINATOR (Fractions, C19).

B: Common denominator?

T: It was this Pizza for 3 kids and you had to split it up for all of them. It was real easy.

B: Could you work this problem for me: 35 x 7?

T: That would be 245.

B: How'd you do it? In your head?

T: um hum.

B: How could you show it's right?

T: (Ted wrote it down and marked it)

$$\begin{array}{r} 35 \\ \times 7 \\ \hline 245 \end{array}$$

B: Is there another way you could check to see if it's right?

T: One of the cheating ways you can do it is to use a computer or calculator.

B: Why is that cheating?

T: It's against the rules that you can't use a calculator in school when you do math--or else you'll get a failing grade.

B: If you just use it once would you get a failing grade?

T: I guess so. Usually I would bring the calculator to school just to use to play MAKE A BUNDLE (Whole Numbers, B3).

B: Oh you would like to use the calculator to play MAKE A BUNDLE?

T: Yeah, MAKE A BUNDLE's a really fun game. It's the game where you start out with 100 dollars and pick around to see which one's good. You get four categories, etc.

June 24

Ms. Hamilton said that PLATO made a big difference in Ted's life at school. She used PLATO as a behavior modifier. She said she had to. Ted was terribly competitive and gave up if he couldn't win, but not on PLATO. She said that when he was finished with PLATO he was finished with school, so he was required to finish other lessons before he could go on PLATO. Later she extracted a promise from him that he would do his work if he was allowed to go on earlier. By the end of the year he became more self-controlled and happier. Ted was one of the ones who wrote a derogatory note to PLATO. Ms. Hamilton had him write a note of apology to PLATO.

Ms. Hamilton said, "Ted is doing much better. His work habits have improved a lot. At the beginning of the year, I couldn't get him to write a sentence. Today he chose writing as an activity. His coordination is poor, but he's very fast on PLATO. Ted has gained

much more control and his writing has really improved. Ted is happy with himself now and I feel PLATO gets a lot of credit, maybe not all, but PLATO made a big difference."

TED'S NOTES ON PLATO

LESSON SORT EQUIVALENT FRACTIONS
MODULE EQUIVALENT FRACTIONS

DEAR PLATO
WE THANK YOU FOR SORT FRACTIONS BUT IT DOSE NOT SOOT OUR
PRESENT NEEDS

DEAR PLATO
YOU ARE VERY RUDE 67899989NP4Y=46I1790349BOMPU=79 M=37=W

DEAR PLATO
I HATE YOU

DEAR PLATO
YOU ARE A FINK

DEAR TED, I HAVE NOTICED THAT YOU ARE UNHAPPY WITH PLATO
LATELY. WHAT IS THE PROBLEM/ MRS. HAMILTON

DEAR PLATO
I APPOGIZE FOR CALLING YOU A FINK.

AROUND THE PLATO TERMINALS
THE MICRO-CULTURE OF THE PLATO SPACE

In the classroom, the space around the PLATO terminals was a busy, happy, helpful place. In Ms. Hamilton's classroom children played games together. They assisted the persons nearby with problems on PLATO. They sat in rapt attention to ponder what combination of 6, 1 and 5 might yield 10. It was difficult to draw their attention away from the terminals for any extended period of time. At one point, this observer had expected to interview children while they were at the terminals. The idea was given up because it annoyed the children considerably to be interrupted for discussion.

Two children could be playing a game together and making all sorts of comments and noises while other children attended to their own terminals oblivious to what was happening around them. Concentration on the tasks was usually intense. For instance consider the following example. One day three children worked on PLATO while Jon was on the fourth terminal discussing his game with Ben. Jon saw on the screen that Ben's sister, Shelly was playing TORPEDO (Fractions, C22) in another classroom. Jon challenged Shelly and yelled and yelled to Ben who was in another part of the classroom, "Ben, I beat her. Ben, I beat her." Ben said, "O.K." The other three children continued to work at PLATO unterrupted. Jon continued to play TORPEDO and was eventually beaten by PLATO. He didn't announce his defeat.

There was a sharing of ideas and a sense of community around the terminals. While they were on PLATO, children associated and made

friends with others who were not normally their friends. This surprised me. In other parts of the room, certain friends stuck together or boys spent little time with girls, but around the PLATO terminals, children seemed to accept anyone near them and to respond positively to requests for help or to general comments or frivolity.

Children gathered around the terminals discussing games and lessons. "Shoot five point two," Debbie said to Peter, "Then you'll hit the balloon." Peter was writing numbers to shoot darts at balloons tied to a number line. Children liked to help others win games. They also helped each other with lessons. Wendy was having trouble with fractions. Lizzie, on an adjacent terminal, took a moment from DECIMAL NAMES FOR FRACTIONS (Fractions, G5) to explain to Wendy how to make one half from sixths and one fourth from eights. Wendy was working on the lesson, PIZZA: REMEDIAL CUTTER STUCK (Fractions, B10). In this lesson the student operates a Pizza Place. The automatic pizza cutter is stuck, requiring the student to use, for example: eighths to make a half. Wendy took time out to discuss what level Sara was on. PLATO informed the children of their progress according to levels reached. Children were interested in keeping track of their progress by level and comparing it to other children's progress. Helping with lessons was generally a positive thing, however, too much help could distort the PLATO information on a particular child and advance the child's prescriptions to an impossibly difficult level. Wendy finished PIZZA and came to GAME SIOT. She went over to her friend and asked her to come to the terminal so they could play the game together.

Ted was observing other children at the terminal and showing them how to make whales and other animals on the screen. He gave Tom the code, "A whale is SHIFT, FRONT, MICRO, six, seven, eight, nine." Like other children at the terminal, Ted was interested in exploring all the possibilities of PLATO and was learning how to make the PLATO terminal work for him.

On another day, Leslie was quietly working while two girls making monsters said such things as, "I'm gonna make a moth man," "I'm gonna make a grumble bum" and "Oh, goodie, MAKE A MONSTER (Fractions, B14) is required." Teachers required certain lessons and allowed some choices. Leslie continued to work on STICKS "N" STRING (Fractions, A9). She used her fingers to estimate half of the string, one third and so on. Leslie shook her head when she didn't estimate three two's correctly. It confused her, but after 3 tries, she was correct. Sally asked Leslie, "What are you doing, Leslie?" Leslie said, "Sticks."

The design of the lessons frequently appeared to diminish the students' self-consciousness regarding their performance. The fact that children's errors were taken into account in the lesson development contributed to the children's acceptance of their performance. Many of the lessons treated errors with a sense of humor. Each child responded with his or her own sense of humor. It seemed to me that the authors of the lessons were trying to create an atmosphere where the child's cognitive and affective domains could grow simultaneously. The children enjoyed the humor in the lessons.

In GIMME (Fractions, E3) Ted was dividing candy bars. He shortchanged one of the boys by not giving him the correct number of boxes of candy bars. The candy bars were not divided equally, and when the sad face of the boy, who didn't get his share, appeared on the screen, Ted laughed. He had made the mistake deliberately to see the funny face.

PLATO, of course, cannot tell whether a student has made a bona fide error or has deliberately typed in a wrong answer just to see the funny faces. And it is impossible for the authors to list in advance the variety and scope of wrong answers that the kids will come up with. The creative abilities and generalizations of the children range above and beyond the programmers. However, in most instances the developers have anticipated enough of the children's thinking and provided enough indication of the lesson's intent to enable the children to figure out the lesson.

Billy could not understand the lesson, NUMBERLINE MULTIPLICATION (Whole Numbers, D17). For Billy 15 x 32 didn't seem to equal 5 x 32 plus 32 x 10. He was helped a bit by PLATO's questions and hints but never did get it completely (It was a question of reality that 10 of something plus 5 more of them, equal 15 of them; this idea is the basis of what is known as the distributive law.)

Peter was trying to make one-fourth. PLATO options were to use one twelfth, one half, one eleventh, one sixth, one seventh, one eighth to make one fourth. He used halves and twelfths and then sevenths and elevenths. He never did figure it out and shifted out

of the lesson. In these instances, the teacher could review the data and possibly see what Peter and Billy were having trouble with. Ms. Hamilton did this often in order to keep her pupils from getting stranded.

High ability children were sometimes frustrated by the procedures that they had to go through in order to continue on the terminal. Ann was at the terminal working on EQUIVALENT FRACTIONS GENERALIZED (Fractions, C14). When PLATO asked her to show why her answer was right, she hit the panel and said, "Oh I know it, I don't want to show you why."

On the other hand, after a few months of using the terminals such children quickly assessed PLATO's capacity to be wrong. At first they were overwhelmed by the great capacities of PLATO, but they got over it. They learned to use it as a machine and not as a powerful unknown or something to hold in awe.

Children evaluated lessons and suggested improvements. Jon said in the student comments on PLATO, "PINBALL IS FUN BUT YOU SHOULD BE ABLE TO WIN FREE GAMES. ALL THE NEW GAMES AREN'T CHALLENGING. NO REAL FUN. HOCKEY (Whole Number, I1) IS FUN BECAUSE IF YOU'RE GOOD, YOU CAN STILL LOSE. GET IT?" He called PLATO "CHEAP" because his lesson was terminated after 26 minutes. The children liked to get 30 minutes at least.[1]

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[1]PLATO was programmed not to interrupt a child in the middle of a task. For each task PLATO computed the average time required by many children; then, for each individual child, PLATO computed his/her personal "speed factor"--perhaps a child tended to take 15% longer than the average child, say, or perhaps he/she could complete tasks in 70% of the usual time. From these two numbers PLATO could estimate how long this particular child would be likely to take on a particular task. If

Children became disgusted when the keys wouldn't work. Peter said, "This number 5 key is all messed up." They also recognized PLATO's mistakes, Kathy said, "You dummy PLATO, I multiplied the problem right." She had. Errors of this sort were usually caused by noise on the telephone line that connected the terminal to the central computer. When playing BATTLESHIP (Graphs, 1b) children often told PLATO, "You cheat, you really know where my battleship is." And of course PLATO did know. But when PLATO was working, he/she played by the rules.

PLATO provided a special space, a space in which to ruminate and even to be alone. Children there could command a short period of privacy.

In this room, care was taken to respect the rights of the individual child to interact with the terminal without interruption. Even though children were accustomed to asking others for help, they accepted the right of a child not to help. Sally was working next to Erica. Erica said, "I'm getting stupid games." Sally said, "Me too." They were working on MAILBOX (Whole Numbers, G4), a skip counting game. Erica watched Sally and Sally said, "You do your own." Sally counted to herself as she went along. Sally progressed into SPEEDWAY (Whole Numbers, B1). "Good, good, good," she said and played the game. When HOCKEY was her next choice, she said to Erica, "HOCKEY, how do you play HOCKEY?" Erica responded, "Well, try it." Sally tried once,

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he/she would just be getting started before his/her session was up, PLATO would wait and start that task at the next day's session. In this way sessions were made to average about 30 minutes each without interrupting a student in the middle of a task.

and then shifted out of HOCKEY and into a task about NAMES FOR TODAY'S DATE (Whole Numbers, F1). For some children PLATO was a space away from others. Bob said, "Well, I just use it (PLATO) sorta like a slot for myself--gettin' away from all those other people in the classroom."

Children were not forced to use PLATO. It was a privilege. Anyone who abused the privilege could be restricted for a day. For instance, one day Tom wrote a note on PLATO, "WHY DON'T GET A GAME SLOTE YOU MAD SOUK A EAG KISS IT TO PIG YOU FAT COW 9 = 90." The teacher responded on the terminal: "I THINK YOU CAN WRITE A MORE INTELLIGENT, POLITE NOTE THAN THIS. IF NOT, PERHAPS YOU WOULD RATHER NOT USE PLATO FOR A WHILE.....MS. HAMILTON."

This response by the teacher was not inconsistent with her actions in regard to other materials in the room. Sheila recognized the tremendous power of PLATO to motivate and took advantage of the situation to encourage children to become more responsible for their actions. She calmly discouraged immature and self-pitying behavior--also discouraged being too emotional about such incidents.

The children showed responsibility in the classroom. Children talked about finishing lessons before going on to games. They took the responsibility for completing lessons and worked hard to do so. In the story of Ted, he finished many levels of fractions before he would give up and go on to games, even though he loved games and was aware that his time might be up before he got a game for the day. Kate, who at first, couldn't remember to tell another child it was

their turn on PLATO, later took the responsibility to see that the terminals were always in use. Most children didn't need to be reminded to work on PLATO.

Having only four terminals in the room created problems. Children had to be organized and scheduled in order to get every one on the terminals for the day. It also contributed in very positive ways. Children learned to share and be flexible. Ms. Hamilton made sure that everyone had a turn but the children had to be ready to trade turns if that made it easier to schedule reading or music lessons. No one's time on PLATO was fixed. Having only four terminals also made the time on them precious. Since Ms. Hamilton could not be with the children at the terminal and carry on other activities too, the children were allowed to help each other with problems on PLATO. Children exchanged ideas and helped each other as they worked at the terminal. This created a very social learning dialogue between the children.

The degree of competitiveness that PLATO generated seemed to be partly a function of the general atmosphere and structure in the classroom. Smith and Pohland (1975) also found varying degrees of competition in particular classrooms and buildings when Computer-Aided Instruction was implemented in the Rural Highlands.

In Ms. Hamilton's room competition was a part of the everyday life in the classroom. There were contests with prizes for citizenship as well as for mastery of facts in arithmetic. The competition seemed to focus more on measuring an individual's previous accomplishments

with more recent ones rather than comparison with others. For example, the "Space Race" was designed to teach all of the addition, subtraction, multiplication and division facts. Each student received a prize when he/she reached the moon, not just the first one who landed.

The children were accustomed to competition and PLATO gave those children who wanted to compare and compete, opportunity to do so. Children would brag about: how far they were in certain lessons, how many games they had won, how fast they could type, who had done the most lessons, who had the most time or sessions on the terminal, who had won the most games, etc. I didn't sense a feeling of unhappiness because of the competition. No one wanted to stop using PLATO because they were being outdone. They did ask to do games and lessons that they saw on the screen when others were working. In other rooms there were some instances of hogging the terminals and not sharing that was not very evident in Ms. Hamilton's room.

It was an unwritten rule in the classroom that children should not make derogatory remarks about PLATO. Such notes were interpreted by the teacher as evidence that the child didn't appreciate the opportunity to be on PLATO. Ms. Hamilton paid attention to notes the students wrote to PLATO. Other teachers might have been more accepting of the derogatory notes and might have considered it a good chance for the child to express hostile feelings without being reprimanded for it. Ms. Hamilton took it as an opportunity to direct the younsters toward more "responsible" action. But the PLATO-child encounter was

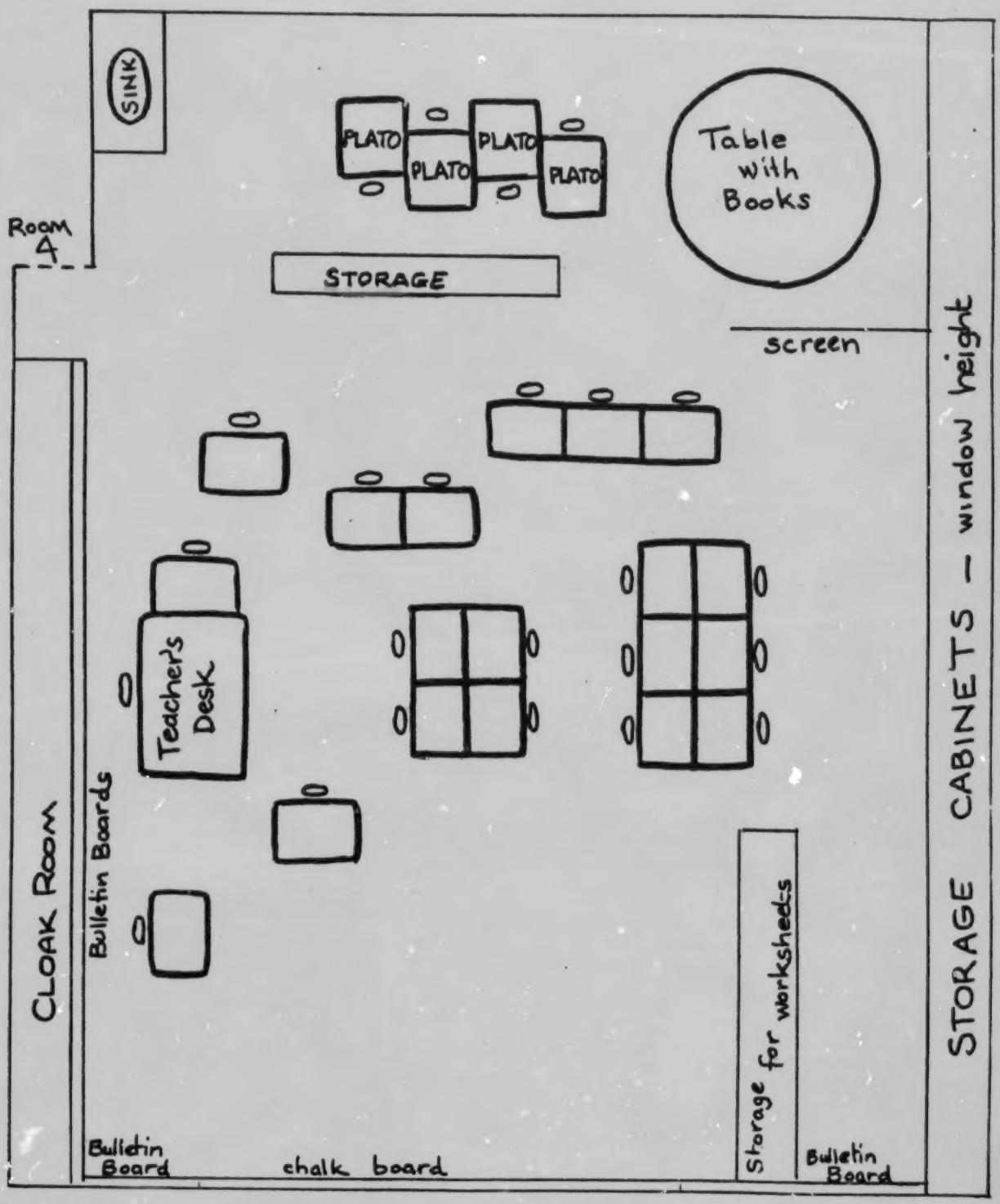
so natural and compelling that the most ordinary language continued to spell out across the screen, as the child responded to PLATO's cleverness and dumbness.

UTILIZATION OF PLATO
THE TEACHER'S RESPONSE

This is the story of Ms. Hamilton's first two years of teaching with PLATO. The story of the first year, 1974-75, was drawn from Ms. Hamilton's teacher log, a few classroom observations, teacher interviews and random observations of students at the terminals.

More information was collected the second year. Observations in the classroom were more frequent, the teacher's log and interviews with teacher and children added a third dimension. Three particular children were observed over two semesters to detail their progress on PLATO: Sara, Ted and Kate were children of the second year.

These observations were made as part of the Educational Testing Service's evaluation of the PLATO project. The evaluation was part of a long and complete study done for the National Science Foundation. The elementary school data collected were intended to be aggregated as a part of the whole, and originally were not intended to be specific to a single classroom. According to the plans, the aggregated data alone were to tell the story. At the beginning of the second year, a decision was made to study one room in more depth and to produce case studies of a few children in that room. Ms. Hamilton's room was chosen, perhaps because she had kept the best log the first year. The children chosen to be observed were not the math "winners." Two children who appeared to have average math ability turned out to have more ability than was expected. Another child whose work at school was usually graded as "failing" experienced some success with PLATO math.



September 11, 19

Ms. Hamilton
Johnson School
Room 4

THE FOURTH GRADE CLASSROOM--YEAR ONE

The teacher's role in the classroom is a major determining factor of the climate of the classroom. Ms. Sheila Hamilton structured and controlled the environment to allow children some freedom to work independently and to be creative, but that freedom was dependent upon the children's acceptance of responsibility in making choices. Ms. Hamilton organized lessons and activities so that the children had limited freedom of movement and socialization, stressing concern for the rights of others. Children were given more and more freedom as they accepted responsibility. Usually they were not responsible for determining the content of their lessons. They could select when they wished to work on required lessons and their privileges were determined by their ability to finish work.

Sheila Hamilton's teaching of fourth grade children reflected an adventurous and creative spirit. Sheila had traveled in many countries, bringing back slides and cultural artifacts which she shared with the children. She took the children on educational excursions including a visit to the State Capital. These trips provided a special opportunity for Ms. Hamilton to teach concern for others and responsibility while they were learning about the tools and customs of other times and places.

On her own time Ms. Hamilton studied history and portrait drawing. In school she helped children build Egyptian tombs, sew pioneer quilts and model Indian artifacts of clay. She had a

well-developed sense of history and culture and tried to impart it to the children.

Ms. Hamilton is committed to the teaching profession. She says "The only trouble with teaching is that it consumes all my time." It consumes her time because she is always doing extra projects and taking trips with the children. She is interested in new ideas and wants to try out those ideas to help children learn. Sheila seems to be able to make innovative changes and at the same time protect the classroom atmosphere and herself from great disruption. She protects the old while trying out the new.

Sheila Hamilton was introduced to PLATO at the same time that she was introduced to a new school. In the fall of 1974 when she began teaching she was dismayed by the behavior of the children at this school.

September, 1974

> Teacher's Log: I am not one of the original volunteers. I was assigned to Johnson School in August and moved to the community a few days prior to new teacher orientation. I had heard of PLATO through friends who were greatly impressed with it and excited by it. After first using PLATO my feelings were mixed. I was impressed and excited but also frustrated. I knew that some of the children had used PLATO and would be more at ease with it than I. Also, I learned, teachers were to have spent 40 hours on PLATO during the summer. New teacher orientation had been overwhelming. This district is "super organized." There seems to be too many things to remember, too many materials with which to become familiar. In addition came the question, "What is expected at Johnson School?"
>
> The latter was probably the most frustrating. Resolving it left little time for concern about PLATO.

The first week of school was a nightmare. I felt the children were generally self-centered, lacking self-discipline, unable to function in group situations and disrespectful to each other as well as to adults. From the cum. folders, I learned all but three of the 22 should be able to work at or above grade level. Six of the 22 had previously been scheduled with the social worker. I recommended an additional two. Six had been in other supportive programs. This year Debbie has Title I assistance in reading; Nancy works daily with the learning disabilities; Barry, Sally, Frank, Kent, and Larry are seeing the social worker. Larry, Sean and Sandra have shown immature outbursts of temper. Peter, Larry, Nancy and Sean have refused to work with our Title III instructional aide. There are other, more subtle problems with the class. I have cited these to indicate special problems and hint at the atmosphere they tend to create.

I am not a novice. This is my 14th year of teaching elementary children. Child behavior has <u>not</u> been a problem for me in the past. With this class freedom leads directly and immediately to confusion and disorder. The children are difficult and responsibly immature. Currently my impressions are as follows:

Barry--easily distracted, clownish, bright with very poor study habits. Adrift--possibly due to problems at home, lacks concentration, works only in one to one situation. <u>Very poor</u> work habits, poor work.

Sandra--does not interact well with other children, wants to do well, works hard, gets angry when she doesn't understand something, cries when teased by other children, tends to feel others don't care about her--may result from home problems.

Anika--conscientious, works hard and usually well

Gary--bright, well-adjusted, happy, alert, polite, does work quickly and well, above grade level in all areas, popular. . . . .

I have taught in traditional schools. Johnson is considered a school open to new ideas and methods, tending toward the open classroom. Although I have read about and visited some open schools, I have had no formal training for this approach to education. During the first month of school, I found myself constantly revising the organization of my teaching. PLATO was not yet in operation. I knew it must be integrated

into this organization. I soon discovered that children were willing to work only on the assignments that were "R R" (required for recess).

Having talked with more experienced "lab school" teachers, we switched from daily to weekly goals. The first day of the week assignments were given in math, spelling. language arts, and science. The assignments were posted on the board. The children were expected to plan their daily schedule, reading being the only daily requirement.

Math September 16-20

1. Math progress check - Monday
2. Practice x's facts at least 15 min. each day
3. Be ready for x's challenge
4. Groups

I	II
[1]SRA p. 24-30 (self check)	MIA p. 43-49 (self check)
[2]MIA p. 52-60 (self check)	SRA p. 15-17 (self check)
2 worksheets	3 worksheets

September 16, 1974

Ms. Hamilton considered teaching whole numbers the main objective in fourth grade math. On the long bulletin board above the cloak closet a space game illustrated the children's progress on addition, subtraction, multiplication and division facts.

Teacher's Log: I also gave diagnostic math tests. I used flash cards. They were given 5 seconds to look at the card and write the answer. Those to get all addition correct were: Kent, Andy, Debbie, Larry, and Gary. All subtraction correct: Debbie. No one did at all well on multiplication or division.

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[1]SRA--DeVolt, M. V., Frehmeyer, H., Greenberg, H. J., Venuzks, S. J. Mathematics Learning System Texts, Science Research Associates, Chicago, 974 IBM Subsidiary.

[2]MIA--Denhalm, R. A., Hankins, D. D., Herrick, M. C., Vojtka, G. R., Mathematics for Individual Achievement, Houghton Mifflin Co., Boston, ISBM 0-395-14796-4.

A "challenge" system was set up for basic facts. The planets and sun were displayed and "rockets" labeled with each child's name--orange for addition, green for subtraction, yellow for multiplication, blue for division. On the basis of the diagnostic testing each child's name was placed under a planet for addition and subtraction. Pluto meant a fact with ±1 or (-1) was missed and so on to Mercury +9 (or -9) missed fact. Since no one did well on x or ÷ no rockets were placed.

Individual flash card challenges were given each day--oral responses. If they were successful on their planet, they moved their rocket to the next planet toward the sun and had one chance that day to move again. They could continue taking challenges and moving until a fact was missed. When + or - 9s were passed the entire set of cards were given. If this was passed the rocket was placed on the sun. After two weeks, half the class had passed addition, about 1/4 subtraction. We started to concentrate on multiplication about the 3rd week of school.

Skills of carrying and renaming were also tested. Almost everyone needed reteaching and lots of review with renaming in subtraction. Addition results were good, but I was aware that many children were finger counting.

By the third week, most children were not handing in daily plans and could not remember their assignments. Therefore, an individual copy of assignments with a check-off list was started. The children seemed to find this easier to handle and more assignments were being completed. There was less question about what there was to be done and it was easier for the child and myself to see what had been accomplished. Papers and the check sheets were put in folders with the child's name and I go through each folder every night.

Each day I meet with small groups to discuss new concepts or problem areas. I also meet with each of the reading groups. Individual conferences are used to discuss work, give special help, or special assignments. I find that these children are attentive in small groups, but even the better students lack attentiveness when the entire class is addressed. Several times a week we have 20 to 30 minutes of quiet reading-material of their choice. Most of the children look forward to this time and become very engrossed in their reading.

Our first PTO meeting was an open house. Since PLATO was

not yet in operation there were not many comments concerning it. A few parents asked when we were to begin using it.

Since there had been several dates given for starting and several delays, I decided not to give my class a date of operation until that day arrived. They waited patiently--after the initial questions when the terminals were placed in the rooms.

Sheila's log shows repeated concern for organization and structure in the room.[1] She tried to create something of an optimum learning environment for the children. She kept records of children's progress in all subject areas. The children's folders of work were carefully checked and sent home for inspection. Sheila quickly arranged the classroom to include the PLATO terminals. She set up a schedule immediately and revised it regularly.

September 16-20

Teacher's Log:

Graphing Strand. Don Cohen came to the room to sign each child into the terminals giving them the procedure and getting their sign-on and passwords. This was done individually and took a couple of days. At this time the terminals were arranged so that each unit faced a different direction. This proved unsatisfactory as it was difficult to observe the terminals, get to them quickly and make sure that the right person (or anyone) was on a terminal. They were placed in a line, facing the same direction. This has been much better for monitoring and children are often able to discuss differences or ideas and help each other. At Don's suggestion a 2" board was placed under each terminal at the back. This reduced glare from our lights on the terminal display.

It was necessary to set up some type of schedule for use of the terminals. At first a card was placed on each terminal. Names and check off boxes were on each card:

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[1]Ms. Hamilton individualized much of the instruction in the room, which made it easy to fit PLATO into the day's schedule. For whole group activities, she frequently turned the terminals off.

	M	T	W	Th	F	M	T	W	Th	F	M	T	W	Th	F	M	T	W	Th	F	M	T	W	Th	F
Kent	X	X	25																						
Anika	X	X	32																						
Sally	X	X	20																						
Barry			27																						

At first children were asked to put an X or fill in the box when they had completed their turn. Later they were asked to tell how many minutes they were on. There was a great range, sometimes from 16 to 43 minutes. If a child was "knocked off," when they went back in they had a new set of 30 minutes. This caused many social problems.

This method of record keeping was used for only a short time. It was difficult for me to know whose turn it was because no one carried a pencil to the terminal to put a check behind their name. If they remembered to check it off, it meant a trip back to their seat for the pencil--altogether too much movement without good reason and plenty of confusion. We were always asking who had had a turn.

A vertical row of library book pockets were placed on the chalkboard for each terminal. A number was placed on the terminal and at the top of the vertical column. Cards with each child's name were placed in the pockets with the name showing. As a child finished his turn, he took a couple of steps to the board turned his name card over so that no name showed and went to get the next person below him. It is easy to check terminal use from the opposite side of the room. Also, if a child forgets to tell the next user, someone else usually notices and acts as a reminder. The ones who haven't been on can see how soon their turn will come and if an empty terminal is spotted, it isn't necessary for me to call off names. Instead of a specified time block (Mary 9-9:30), we start at the top and just advance until all are finished. If someone is out of the room or meeting with a special group or teacher when their time comes that person is skipped. Also if those on one terminal complete their lessons early (due to absences or other reasons), it is easy to spot and transfer a child from one terminal to another.

Sheila discovered on the first day of using the terminals that PLATO had a potentiality for motivation and control of behavior.

Several unruly youngsters were intrigued with PLATO. It served from thereon (in part, of course) as a reward for good behavior in the classroom.

> Teacher's Log: The children were all eager to begin using PLATO. A few had had limited exposure at the end of third grade; a few had older brothers or sisters who were signed into PLATO and let them on once and a while. For most children it was the first time. They picked around a little with the keys, but soon learned which ones were most needed and before long they were hardly looking at the keyset.
>
> Two children made great impressions the first day of terminal use.
>
> Larry had been a problem since he put his foot through the door. He was obviously in need of a great deal of attention--not from classmates--from the teacher. Anytime he did not receive "instant attention" he laid on the floor, making loud noises, kicking his legs. This was not a new behavior for him. I learned that he enjoyed verbal battles with previous teachers. He was referred to the social worker and I tried to give him positive interaction as soon as he entered the room and frequently throughout the day. He is very resistant to any form of testing and becomes quite upset when he doesn't understand something or feels he cannot perform a particular task. If he doesn't receive immediate help, he starts making noises loud enough to disturb others trying to concentrate. After a week, I discovered that the most effective method of working with Larry was to try to avert problems by testing him on a 1 to 1 basis as soon as an assignment had been given so that I could be sure he understood and felt confident. If he became upset, it seemed to be most effective to ignore his negative behavior. This was, at times, very difficult. After a cooling off period, it was often possible to get him back on the track with coaxing. Sometimes the behavior could not be ignored and he was told to leave the room until he could control himself.
>
> Larry had had some experience with PLATO. He was at once at home with the terminal. This was to date the only task that he tackled "on his own"--the first non-one to one achievement. From the first day he was staying after school for an extra turn. Since he is one of the few neighborhood (non-bused) students this was possible. This became an important factor in control. He could stay for an extra turn only when he had been cooperative during the day. This motivated him and slowly he began

to correct his behavior. He often stays an hour after school. Many times Peter stays and occasionally Larry.

Barry had no previous experience on PLATO. Although his behavior was not as unusual as Larry's he had also been referred to the social worker. He and his brothers (2 younger) had been living with his divorced father, visiting their mother on a weekly basis. The father remarried shortly after school started. Barry was so upset that he didn't come to school for several days. His study habits are extremely immature. He accomplishes nothing and seems to remember very little of practiced skills. He missed almost all addition and subtraction facts and doesn't remember borrowing in subtraction. I teach him renaming every day. The next day--or even the same afternoon--he has forgotten and we must go through all of it again. His attention span was two or three minutes, even on a 1 to 1 basis. He is frequently in trouble on the playground and in the hall. I have had to be very strict with him as he quickly takes advantage to act silly, poke at classmates, or play. He has learned to behave in my presence, but cannot be trusted to do any work or keep his hands to himself if I must leave the room or turn my back too long. His papers (when he puts anything on them) are very poorly written. He seemed to have little success in any academic area.

I watched Barry as he first signed in and started to work on the terminal. I couldn't believe this was the same boy. He was at last catching on quickly and performing well. This was his first success in over a month of school. PLATO is the one thing he is ready and anxious to do. He watches for his turn and is happiest when he is using the terminal--gladly gives up recess for his turn.

PLATO seemed to provide a special private space for some children. They could be engaged in learning new skills in a non-threatening atmosphere and at the same time be rewarded by instant feedback. Children somehow felt accepted and satisfied to the extent that they did not need or want to protest. Instead they enjoyed the challenge of the lessons. Sheila Hamilton was grateful to have found a way to reach children who seemed to find most of their school day an unrewarding experience.

October 28

Ms. Hamilton settled the children down to a quiet working atmosphere. An observer noted, "There was a low buzz of conversation and kids were allowed to move about the room as they pleased. I have a feeling that there are underlying rules about this. The room is less tense." Another observer: "Children work quietly alone, occasionally a couple of children interact. Otherwise interaction is with the teacher."

Four children worked on PLATO terminals and the other children worked at their seats on worksheets. Ms. Hamilton supplemented PLATO math with her regular math lessons. GRAPHS was the only strand "running" on PLATO in October, and GUESS MY RULE (Graphs, 4b) was one of the main lessons. Ms. Hamilton prepared GUESS MY RULE worksheets to accompany the lessons on PLATO. Children worked on the worksheets and referred to examples on the chalkboard of GUESS MY RULE.

Sheila monitored the children as they worked on their weekly assignments. Children were expected to finish a plan of assignments each week. She prepared a form to help the children schedule their week's work.

Teacher's Log: Each child was given a piece of paper such as this (8-1/2 x 11):

	Monday	Tuesday	Wednesday	Thursday	Friday
What I plan to do					
What I did					
	L	U	N	C	H
What I plan to do					
What I did					

Of course, this had to be correlated with times for special subjects. That schedule is:

M	T	W	Th	F
Music 10:45-11:15	P.E. 9-9:30	Music 10:45-11:15	P.E. 9-9:30 Library 10:45-11:15 - every other week	P.E. 9-9:30
LUNCH	11:45-12:15			
READING WITH INSTRUCTIONAL AIDE TITLE VII 12:20 - 1:20 DAILY			45 min. Design Lab every other week	

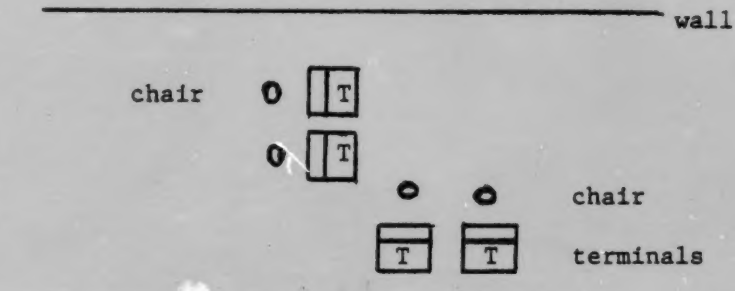
Since Johnson School has open enrollment nearly everyone comes by bus, some children arriving as early as 8:30 or as late as 9:00. We officially begin the day at 8:45 and dismiss at 2:35. Our noon break is 30 minutes and children have one 15 minute recess per day.

October 29, 1974

Children were working on individual lessons. Ms. Hamilton was sitting at her desk and individual children came up to her to talk about the lessons. The room was decorated for Halloween. Children's writing and other work was displayed. A chart for the Halloween Committee meeting listed activities for the party. On one bulletin board was a "A Packet of Puzzles at the Blue Kangaroo" (puzzles for children to work at their leisure), another had The Leaning Tower of Piza (a picture done by kids). Children worked quietly alone. Occasionally a couple of children interacted, otherwise interaction was with the teacher.

GUESS MY RULE problems were written on the black board with examples of possible solutions. Obviously Ms. Hamilton was helping the children with this PLATO lesson.

Two of the terminals were situated so the pupils were visible from other parts of the room. The other two were placed at right angles so the terminals separated the pupil operators from the rest of the class, as in the diagram.



Harry was at the terminal. He had finished TODAY'S DATE (Whole Numbers, F1) and talked to PLATO as he continued with BATTLESHIP (Graphs, 1b). "Look how PLATO is moving" "Who hit him?" "I've got him cornered." Harry kept choosing correct responses. Then he talked to the child next to him. "You beat me so much." "Golly I'm havin' a hard time." When Harry chose TOWER OF HANOI (Graphs, 4m) Don Cohen, developer of the graph strand of lessons, told him how to move. Harry said, "I know how to play." Harry worked at TOWER OF HANOI. After many moves PLATO showed Harry how to play.

Ms. Hamilton became concerned when the terminals were not working because of ECS problems or hardware failures. When children didn't get a proper session it created problems.

> Teacher's Log: Our biggest problem with PLATO has been the allotment of time (Extended Core Storage (ECS) time). The terminals are always going "down." They are off more than on. Children are not getting regular lessons. The lessons--rather session are of irregular length so that some children may get 15 minutes while others get over 30 minutes. Naturally, some feel cheated. Also, sometimes the children get games--no lessons. Of course, the games are learning techniques, but I feel they are not gaining what they could from the program due to the terminal problems.

Sheila monitored the children's work on PLATO in order to correlate and integrate the PLATO lessons with her classroom math. She was teaching graphs and the number facts in addition, multiplication, subtraction and division.

November 10, 1974

> Teacher's Log: As I said, I have been concentrating on their learning basic facts. At the same time, I feel that it is important to correlate classroom and PLATO. Therefore,

the children have had "PLATO worksheets." Sometimes this is done as a part of the weekly progress check.

Most children had discovered the procedure for plotting points on the graph and especially enjoy BATTLESHIP. They were able to make the transfer to paper easily. There were, however, a few children who were guessing at points and needed further instruction in locating them.

Many children were stumbling through GUESS MY RULE, some watching the terminal of a friend for a solution. We discussed patterns in numbers as a group and worked many GUESS MY RULES together. I put a number of card games on the board which they were encouraged to work with their friends. After a couple of days--sometimes a week--we would go over the patterns and rules together. The following are examples of cards they tried:

GUESS MY RULE

□	⬡
Ø	4
1	7
2	10
3	13
4	16

GUESS MY RULE

Ø	2
1	7
2	12
3	17
4	22

GUESS MY RULE

1	8
2	15
3	22
4	29
5	36

GUESS MY RULE

2	7
3	9
4	11
5	13
6	15

GUESS MY RULE

2	5
3	9
4	13
5	17
6	21

GUESS MY RULE

3	27
4	35
5	43
6	51
7	59

At first, the children found these very difficult. Then they began to see patterns and form rules. PLATO began to use minus numbers so we did some like this:

Ø	2
1	7
2	12
3	17
4	22

1	-1
2	-4
3	-7
4	-10
5	-13

Ø	3
1	1
2	-1
3	-3
4	-5

Ø	Ø
1	1
2	8
3	27
4	64

Ø	Ø
1	-1
2	-4
3	-9
4	-16

Ø	1
1	-2
2	-5
3	-8
4	-11

1	-2
2	Ø
3	2
4	4
5	6

Ø	3
1	-1
2	-5
3	-9
4	-13

Minus numbers were confusing, especially when they started minus and changed to plus. Again, I feel that more regular sessions would have helped get the idea across more quickly. A few did quite well--Gary, Harry, Kent and Sandy. After two or three weeks of reinforcement, the major portion of the class was doing fairly well.

The class also did the booklet on GUESS MY RULE[3] prepared by PLATO authors. Some of these were quite difficult. They were given a week to do what they could before we discussed rules. Some took them home and discussed the problems with their parents. By the end of the week, all problems had a rule--except one, which did not have a pattern or rule.

In addition to the GUESS MY RULES given here, the numbers were sometimes given out of order so that it was necessary to organize them before beginning to work on the rule. Example:

3	17
Ø	2
4	22
2	12
1	7

Ø	2
1	7
2	12
3	17
4	22

November 4, 1974

Ms. Hamilton reviewed and evaluated lessons as she monitored children at the terminal. She also spent time working at the terminal after school to review the lessons.

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[3]Graphing Linear Equation's workbooks were prepared by the authors at CERL to accompany the PLATO lessons.

Sheila found NAMES FOR TODAY'S DATE (Whole Numbers, F1) a source of frustration for her and the children. When a child signed into PLATO he/she was required to write a new NAME FOR TODAY'S DATE (Whole, Numbers, F1) such as 8 - 2 for the 6th of November. As mentioned before, each day required a different name and each child was expected to find a name different from those used earlier in the day. Children who signed in early used easy names and others who signed on later in the day were challenged to find something else. Sometimes the requirements would be beyond the child's experience or take too much of the child's time to find a NAME FOR TODAY'S DATE and leave little time for other activities on PLATO. Children were encouraged to use division and multiplication, but addition and occasionally subtraction were most often used. Some children learned to use a series of 0's or brackets to satisfy a new solution: 5 + (0) + (0) + (0) + (1) + (0) = 6. In using brackets they learned that a bracket on one side required a bracket on the other side also, or PLATO would not accept their solution.

When Sheila told Don and Jerry about the problems, they visited the room and worked with the children at the chalkboard to prod their creativitities. They tried to make the business of composing more interesting. The children did well after Don and Jerry's help. Ms. Hamilton kept a "Dates" board where children could record their names for the day opposite their own names to reinforce what PLATO was doing and to emphasize the many solutions: Peter: 18 - 12
Jon: 24 ÷ 4

Certain children acted as "checkers" to determine which names were correct names for the day's date.

December 3, 1974

The children were working on learning the multiplication facts and multiplying with one and two place multipliers. The previous week Ms. Hamilton had worked with groups to teach two place multiplication. This week she worked with individual children who were in the middle (those between one place multiplication and two-place multiplication). In helping a child with two place multipliers, she wrote on the chalk board $\begin{array}{r} 42 \\ \times 13 \\ \hline \end{array}$ $\begin{array}{r} 13 \\ \times 42 \\ \hline \end{array}$ and asked him what the difference in the problems were. Then she asked him why he got the same answer.

Ms. Hamilton gave a progress check the first day of every week and then assigned work in the two texts, Mathematics for Individual Achievement and Mathematics Learning Systems, accordingly. Shelia put the answers on the bulletin board, so children could check answers as they worked. If the lesson was difficult they checked problem by problem. If they were not so difficult, they checked row by row. The bulletin board also had an "Extra Credit Challenge" page of work for those who chose to do it.

On another bulletin board were grocery ads for Thanksgiving. Sheila assigned the top math group the task of composing a menu for Thanksgiving. The children used the ads in the newspapers to select the groceries for a Thanksgiving dinner. They were required to find the total price of the turkey dinner. Some children wrote 41¢ for turkey. Sheila reminded them that turkey was 41¢ a pound. She said this kind of problem was in the Mathematics Learning Systems Texts but the prices were figured out for the children.

Children's rockets were moving along in the Space Race toward the sun. All children had finished addition and subtraction facts. Ms. Hamilton had ordered certificates to give to those people who reached the sun. She thought it would spur the others on to work a bit harder when certificates were given out.

All four children on the terminals started to play CLAIM GAME (Whole Numbers, D31) as they came in from recess. They had the beginning of their lesson before recess, and so had reached the game slots in their lessons. Each child chose a partner to play the games. Ms. Hamilton said she liked CLAIM GAME because the children helped each other and learned from each other while learning the factors.

Hartley had been on PLATO before recess. The children crowded around PLATO when they came in until Ms. Hamilton told them to go to their seats unless they were playing the game. Each child had a partner. Hartley had chosen Oscar. Oscar used his fingers to figure out the factors. These two children had difficulty with factors. For numbers such as 25 and 22 they were unable to claim any factors.

Ms. Hamilton gave some extra PLATO time to some children who needed it. Maria was one. The principal said that PLATO had really helped Maria. Maria left a note on PLATO, "I LIKE PLATO GAME" after playing BATTLESHIP. The principal had been worried about Maria's absenteeism effecting her achievement. Ms. Hamilton agreed to try to get her work time on PLATO more than once a day.

Since the terminals were so much in demand for the children, it

was hard for Sheila to find a time to work at the terminal. She had scheduled children from 8 o'clock on in the morning and after school as well. Because of storage problems, the teachers were not supposed to work after school when many of the University courses were running, so even after 2:30 when school was out she could not be assured of access to the Math curriculum lessons and the children's comments.

Ms. Jones came into Ms. Hamilton's room to get some help with PLATO. She said her name was not being accepted under the COURSE MATH anymore. Teachers sometimes had trouble accessing the lessons because they had forgotten the correct procedures or the procedures had been changed. Ms. Jones and Ms. Hamilton joked about it; Ms. Jones said her hand was slapped for trying. PLATO would print a message saying, "YOU ARE NOT REGISTERED UNDER THIS COURSE," if the course name or procedure had been changed. Teachers called CERL to report the problem and were told how to get into the PLATO lessons.

Meanwhile the children worked independently on lessons. Two were sitting on the window-ledge behind a bookcase reading library books. Two were working on teacher-made language arts worksheets. Four were at a table working on language arts. Two were at a table working on math. One child sat on a window ledge alone reading. Four were at the terminals. Children talked quietly as they worked.

The room showed signs of recent activity. Wire sculpture was displayed and mobiles of pilgrims hung from the ceiling. A beautiful hornet's nest also hung from the ceiling. Unfinished weaving was displayed along the green chalk board. By the sink stood an experiment

with water and sand representing a well. Their study of Illinois--a year long project in fourth grade--was registered on one bulletin board with a map of Illinois marking points of historic interest. A map of Europe focused on Italy was on another bulletin board.

January

Teacher's Log:

Whole Number Strand. Although we had been working on learning basic facts since the first weeks of school, when we started whole numbers most of the class was still struggling and not remembering. Some had been able to pass flash card challenges on multiplication: Larry, Debbie, Gary, Kent, Andrew. The rest were plodding along--not able to remember or willing to work at it hard enough to remember.

I am very strong on learning facts before getting into complicated computation because when computing the child can grasp the idea much faster with less confusion if he doesn't have to be concerned with counting fingers or drawing pictures. They initially need these methods for understanding, but there comes a time when such are impractical and hindering.

After a few weeks on the whole number strand, I could see a definite improvement in these skills--particularly in multiplication. Since each child's progress was charted on the wall (as it had been from the first week), it was easy to watch the changes. Among the first to improve were Sandra, Sandy, Peter, Paul and Anika.

CLAIM GAME was a prime factor in this improvement. I could see it happening on the terminals and the wall chart. Children were helping and prodding each other. At first some did not understand what a factor was. As they began to "catch on" and play against each other, they began to really concentrate and think about all the possibilities. Larry was outstanding. At first he could beat them all. It was a great boost to his pride and self-confidence. Since this is a child who hangs on me for every movement he makes in other learning areas, it was especially great to see him have such a success independent of any adult assistance. His buddy, Peter, who hadn't been working very hard on facts, was a constant loser. Larry and he played at every opportunity and Peter began improving

to the point where he could really rival Larry. Peter has been the only person till now that Larry would play with; however, his success gave him the self-confidence to take on other opponents. Each time a game took place so did learning.

The "off PLATO" version of CLAIM GAME worked for a while, but it soon lost its favor. The "immediate response" of the terminal, its "judgement" of what will or will not be accepted, are important factors to learning. If an adult could sit in on each game, it would be okay, but, of course, this is impossible. PLATO takes that role. I think the most important function is that their mistakes are caught and corrected before they become habits. Immediate response leads to satisfaction, understanding, reduced confusion, elimination (or at least greatly reduced) bad habits, self-confidence.

After a month, almost every child had been able to succeed in the fact challenges--timed flash cards with oral response.

Bobby, Matt, Louis, Betty and Nancy took longer. After 2 or 3 more weeks Betty was successful in the challenges--remember, she has learning problems, gets special help from the Learning Disabilities teacher, tends to react and learn very slowly. Betty has been coming early--45 minutes before class begins--to be on the terminal. Betty has been an extremely shy child with no friends. She doesn't complete even the simplest of assignments. Sometimes, in the presence of the L.D. teacher, it takes Betty 30 minutes to copy three sentences. Sometimes when she is asked a question she just smiles and looks at the questioner--but no response. Another early comer is Debbie--good student, very outgoing, sometimes rather cruel to those outside her "group," a popular, alert, energetic girl. She has been a helper to Betty in these before school sessons. Sometimes she is impatient and blunt with Betty--"Why don't you know that?" At other times, she is patient and reexplains how to do something or what something means. They have played the CLAIM GAME many times. There has been a drastic change in Betty's social behavior. She is talking with her peers. She laughs and plays games. She has become so social that she is talking most of the time. For a while, I ignored her over socializing because I felt she needed this and to try to control it too soon might put her back into her shell. However, after a few weeks, I started reminding her (often by reminding someone else) that there were times to talk and times to be quiet. Her response was good--there was no retreat. She was building real friendships. Her work was also improving. Her self-esteem and confidence were being established. Her change was remarkable--the L.D. teacher who had worked with her for several years could see the change and better responses she was getting. Her parents saw a happy girl at home.

We had all been working with Betty before. I must attribute these successes to the early PLATO sessions and the interaction this caused between Debbie and Betty.

Bobby has had problems at home--father with whom he lives remarried. Bobby was so upset and torn between his natural parents that he didn't come to school for a few days. He is the oldest of three boys. PLATO is the only thing he is attentive to for more than 2 or 3 minutes. PLATO he loves. I think he would spend the entire day on the terminal. His academic achievements are so few that at the first conference, I told his father that unless his performance took a drastic change, I could not recommend him for promotion to 5th grade next year. This is very early for such a declaration, but I felt it was necessary (and very true). Until I saw Bobby work on the terminal, I really didn't think he could do better. I found myself devoting more time to him--perhaps being more patient--and definitely expecting better results.

SPEEDWAY has been another important factor in developing their skills with number facts. The children have taken pride in their improvement. It is good to see them working against their own achievments. Matt and Anika and Debbie especially tell me how many seconds it took them to do a particular race. Their faces indicate how self-satisfied they are. They are very engrossed and are much distressed if interrupted when in the middle of a race.

RUBBER STAMP and ARRAYS are good, but I feel there should be some kind of check-up for understanding at this point. Those who know their number facts and understand what they mean, find this repeated process too time consuming and unnecessary. They feel it is too easy for them. PARKING LOT could also be shortened for many.

In fact, I would like to see whole numbers set up so that children could progress as rapidly as their understanding permits. Children, like Nancy, should not be moved on until they have had enough success to cope with the next phase. I would also like to see whole numbers go much farther--2 and 3 digit multiplication, 1 and 2 digit divisors for those children who are ready. I would also like whole numbers available at the beginning of the school year. Perhaps weekly or every other week check-ups could be inserted.

Our terminal problems are fewer. We are having much more regular sessions. We have had a lot of trouble for 2 or 3 weeks with terminal 4. It keeps putting in ØØØ no matter what is typed. The terminal repairman has checked it many

times. He believed the problem was in the telephone line. Finally something was done with the telephone line--no more problem. Actually, it was an irregular problem. Some days it would work fine. Sometimes it would malfunction for only a few hours. Sometimes it would work properly after using ERASE--sometimes pressing ERASE would put in another Ø. Many times it would work properly while the repairman was here.

March 23, 1975

Teacher's Log:

Fraction Strand. I am most happy with this strand and its operation and management.

Before we started, I was given a notebook curriculum formulated November 197[illegible] shortly afterward, another updated curriculum, March 1975. These were easy to skim, but detailed enough to be of value. The print-out of exactly what will be on the terminal, what the child will see is most valuable. Even though I have seen these lessons on the terminal, I can take the guide home to refresh my memory. I use it for planning correlated activities and especially examining areas where some children had problems. I can show a page to a child to refresh his memory and we can discuss his reaction or problem.

I received a booklet of "Excerpts from the Paintings Library" and "Skywriting and Spider Web Library"--samples of student work. This motivated me to go to the lab and make my own copies--something I hadn't realized I could do (though I may have been told).

I have received weekly course data print-outs from the "overview of performance data." This and accompanying information about who needs help are very useful. Again, I've almost always seen this data before it comes in the mail, but I don't have to stop and make my own notes each day--or worry that I've missed something if we have a string of after-school meetings or workshops and I can't get into a terminal except a rushed minute during the day.

Parent-Teacher Conferences came soon after we started the Fraction Strand. I made print-outs of each child's progress in the first two or three chapters and copies of his paintings from the paintings library. The "paintings" were displayed in the hall and later given to each child--they were delighted.

Other copies were given to the parents at the time of our conference. I used a part of each conference to explain a few things about PLATO and to show each parent what his child is doing on the terminal. Since each conference is only 15 minutes, it was not possible to teach the parent to use the terminal and show them several lessons, so I chose to do the later. I showed the list of available lessons, the "Painting Library" (his own child's paintings, one or two others and how the paintings were made and stored); SHARE A CANDY BAR (one done correctly, one done wrong so they could see how PLATO handles errors in student judgement); SHARE JUMPING BEANS; LIGHTS; STICKS "N" STRING (if his child had problems with this one); PIZZA (one proper fraction, one improper or with cutter stuck); and if there was time MAKE A MONSTER. The parents were extremely impressed. Several of them commented about how they "had never understood fractions." All were fascinated with the procedures used and clarity of the concepts. Everyone made positive comments and several said, "Now I understand why my child loves PLATO so much," or equivalent. There were no negative comments. All knew something about it from their child's comments. A few were aware of PLATO benefits through their occupations. Two or three had operated terminals themselves.

April 9, 1975

Ms. Hamilton was teaching about 7 children the sun-moon-earth relationships. She demonstrated the pull of the moon by having two children pull together and then against each other. Five children were working on teacher-made synonym worksheets. Two children were reading books. Nine were reading the Health Science Series and ansering questions on mimeographed sheets. Two were fooling around with a calendar and four were at the terminals.

There were many posters around the room. One illustrated tornado action, another illustrated facts of the metric system. GUESS MY RULE problems were displayed on another bulletin board.

Scott S. had made a poster showing how long it would take for light to travel from the sun to earth.

186,282 miles light travels each second
93,000,000 miles from sun to earth
499 seconds
or 8 min 19 sec for light to travel from the sun to earth

Outside Ms. Hamilton's room she had displayed the varion prints of children's fractions patterns. Copies of children's work done on PLATO were printed at CERL with a varion printer and given to the teacher (see Fractions). They were "up" for parents to see on a bulletin board in the hallway by the fourth grade room. Children had chosen other work to display in the hallway. They chose to show their work on the metric system, GUESS MY RULE, Math crossword number game, some papers on graphics that were outgrowths of PLATO Math and CLAIM GAME papers. Ms. Hamilton had made up a CLAIM GAME on paper so children not on terminals could work at similar factoring problems.

Several visitors were intrigued with PLATO math. They wondered if "slower" children had difficulty understanding the directions and working out the problems. "Does the program cater to the bright pupils?" they asked.

Peter was working on extra hard GUESS MY RULE, one Don had programmed especially for him. It involved quadratics.

Input	Output
□	⬡
3	18
4	32
5	50
6	72

Guess the rule. Peter did not solve it that day.

A visitor asked Don Cohen what CERL wanted the children to learn in GUESS MY RULE? He mentioned: looking for patterns, variables, open sentences, simple arithmetic and teaching addition, subtraction and multiplication. He said, "And after problem 25 in GUESS MY RULE exercises children work with negative numbers."

Ms. Hamilton was happy not only with the progress that the children made in math, but she also observed children learning from PLATO in other areas.

May 1975

> Teacher's Log: There are several non-math areas that I feel have been greatly effected by the use of PLATO.
>
> Children tend to read school related materials word by word. Our stress tends to reinforce this type of reading—always looking for main ideas and details. Even though we encourage skimming for facts most children are groping word to word--even many of the capable readers. PLATO teaches scanning of the screen--seeing it as a whole--getting a whole image. They learn to pick out key words. If the page is familiar, they are able to glance at the form and pick out enough details to respond rapidly--sometimes immediately. On unfamiliar pages, some of this spotting of valuable information carries over. They want to get to the lessons and games as quickly as possible (so their time isn't wasted). This desire forces them into scanning skills. They use the information pages for information--not as an exercise in reading. Many adults have not learned this skill. Very capable students force themselves into scanning. The average student never does this. Most of my class is able to scan read effectively.
>
> They also have learned to appreciate the need for looking at details on (new) material. When a new option comes up--such as SHIFT NEXT for something else--if they don't read these details they may miss important information.
>
> Phase concentration is another important area. Complete or intense concentration can be held for only short periods of time--moments perhaps. Such periods need to be offset by relaxation (eye movement, position). Normally in a classroom the teacher holds the attention--by various techniques

attention is drawn from one area to another--but the child is being constantly directed. With PLATO, a child begins to pace his own concentration. He determines at what point it is necessary to give complete or intense concentration and at that point may become so completely absorbed that visual and sound annoyances are blocked out. The time of concentration or pattern of relaxed and concerted effort is an individual thing. Children learn to cope with visual and sound interruptions--learn to phase their concentration to their own environment and uniqueness-learn to "self-pace" concentration. For most, just being able to concentrate (truly concentrate) is a new and most valuable experience.

Attention span is lengthened. This is often carried over to other learning areas.

There is a sense of satisfaction gained from using the terminals that cannot be achieved in the normal classroom situation. Solutions in the classroom are often group things. One person grasps an area and it quickly spreads--in the same form. With PLATO the child forms his own solutions.

Even if he picks up an idea from a friend or another terminal display, it is his keyset and his terminal display that he uses and the solutions are his, too. It requires more thinking--can't wait for someone else to answer first. It's their "ball" and they have to "bounce it" themselves. Having done this there is a feeling of achievement and success--pride.

Often in a classroom the average child is discouraged by seeing the brighter child get ideas so easily. They tend to avoid rather than tackle new or difficult ideas or situations. With PLATO many begin to realize personal worth and that if they keep working at a solution they may (through care and persistence) out work or equal those who catch on so quickly.

Children seem to sense that physical qualities (age, height, weight, color, sex) mean nothing in achieving a goal. More important factors are ability, concentration, finger dexterity and determination.

A very subtle idea is that the machine will do as much as they can make it do. It is up to them how far they can go. One can sense in their kid notes that they feel (to different degrees) that they can contribute worthwhile suggestions--that their comments and their notes could make a difference to a particular lesson--perhaps to the entire program.

They have also learned that the solution is important--that

there are many ways to get to a solution. They are willing to tolerate the sometimes dull repetition of "arithmetic" to achieve the satisfaction of "math-number magic." Their achievement in MAKE A BUNDLE (Whole Numbers, B3) is an especially good example of this.

Hand-eye coordination is developed. At this age--boys in particular--develop large muscle control from throwing, batting, running activities. PLATO use teaches not only hand to eye (or eye to hand) coordination but also finger dexterity.

The "short-cut" student who gets it down fast but often incorrectly due to carelessness, learns to be more thorough. The terminal doesn't scold for his mistakes--it simply rejects them and eventually the short-cutter begins to think about what he is doing. Discipline and self-control lead this type of student to success in achieving goals.

I think PLATO is great! I hope to remain in the program.

If we ever go to "PLATO rooms," I would like to work with PLATO and children on a full time basis. I wish that more children could have use of the terminals.

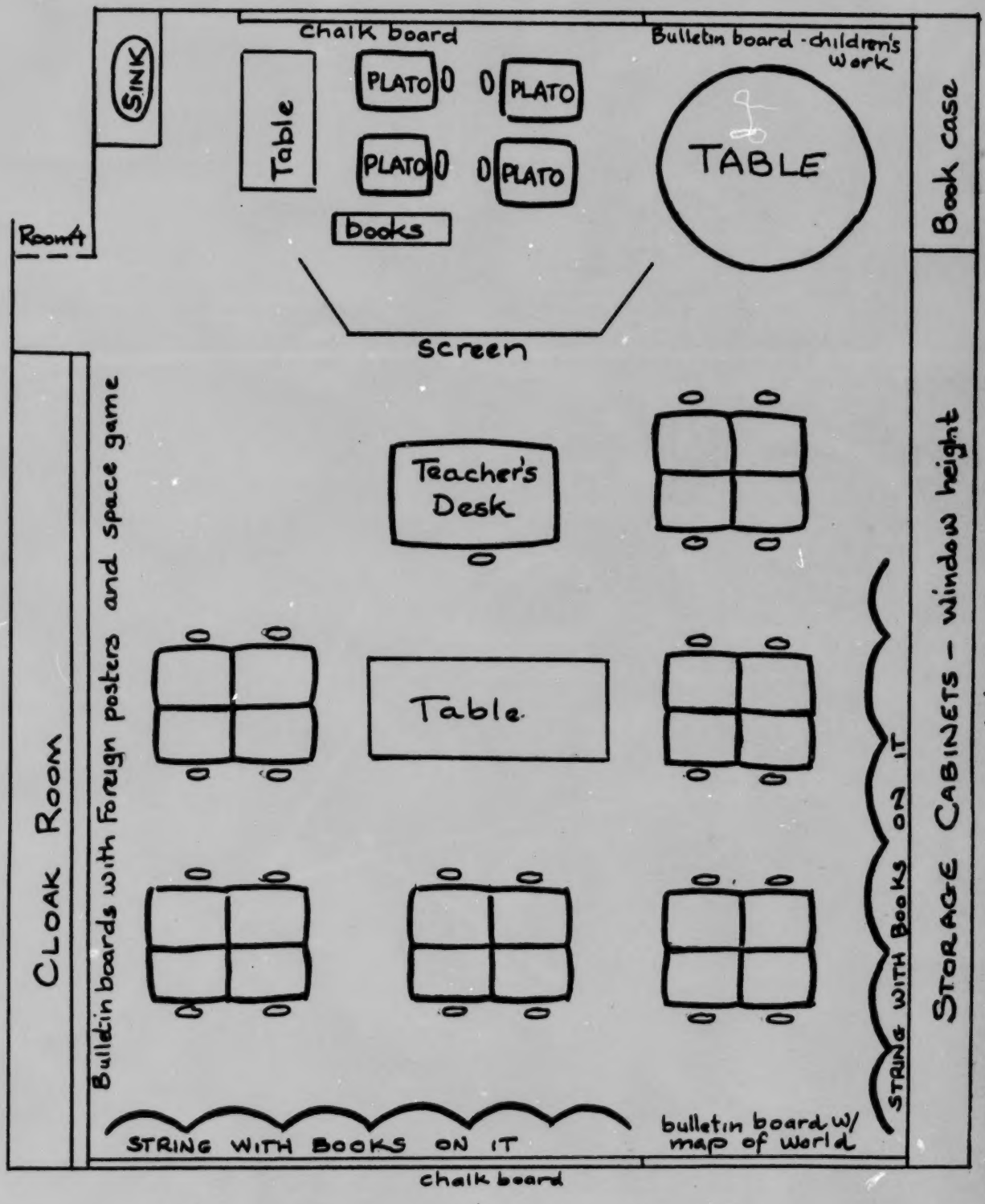
Ms. Hamilton, 1975

Comprehensive Tests of Basic Skills[1]
Arithmetic

Sheila Hamilton, Grade 4th, 1974-75

Name	CTBS-PRE (908)				CTBS-POST (904)			
	Comp	Conc	Appl	Totl	Comp	Conc	Appl	Totl
Kent	35	19	9	63	46	27	18	91
Barry	8	11	9	28	32	17	11	60
Anika	28	18	14	60	46	26	17	89
Matt	21	19	11	51	41	26	17	84
Larry	26	14	9	49	44	21	14	79
Sandra	31	24	14	69	45	25	19	89
Harry	21	24	11	56	44	25	13	82
Nancy	10	5	1	16	23	0		
Martin	19	9	4	32	41	22	10	73
Debbie	37	26	17	80	47	27	17	91
Andrew	24	22	11	57	43	26	19	88
Randy	10	7	7	24	37	17	6	60
Melinda	31	18	9	58	44	23	16	83
Lavis	19	17	12	48	30	22	5	57
Kate	15	8	0	23	42	16	3	61
Dolly	27	20	15	62	42	27	16	85
Sandy	30	18	14	62	47	24	15	86
Frank	18	23	13	54	41	27	15	83
Sean	28	23	9	60	43	26	16	85
Gary	42	28	20	90	47	29	20	96
Peter	24	13	8	45	42	21	10	73
Sally	28	19	17	64	41	28	16	85

[1]Published by CTB/McGraw-Hill, DelMonte Research Park, Monterey, California 93940.



September 1, 19

Ms. Hamilton
Johnson School
Room 4

THE FOURTH GRADE CLASSROOM--YEAR TWO

September 4, 1975

PLATO was not ready for use in September. Six groups of four children were working together on their folders. (Note map of classroom.) The folders contained work assignments for the week. The assignments for the week were written on the chalk board. The children were checking their folders to correct mistakes they had made on work in math, spelling, and language arts. Ms. Hamilton marked the papers that were all correct with a star. Others had to be corrected. The children's names were listed on the board. Each child put a circle around his/her name to indicate the folder was ready to be re-checked and taken home. They could also write their name on the board to get help from either the student teacher or Sheila. The children talked quietly and worked steadily on their lessons, exchanging comments about the lessons or getting help from one another.

Ms. Hamilton stopped working with an individual child to tell the whole group how to get help and to circle their names when their folder was all corrected. Two little boys sat on a table and tilted it. She asked, "Boys, can you see that the table is tilting?" She explained that it was a safety hazard, and couldn't be used for sitting, that "it tipped over several times last year." The children moved off the table without comment. Then Ms. Hamilton finished her lesson explanations and told 3 groups to expect help from her and

3 groups to expect help from Mr. Ebel, the student teacher. Shelia sat down to check folders and the children went back to work.

On the chalk board Sheila had written, "Everyone has the right to work in a quiet room." The assignments for the week were also written on the board. The math space game that Ms. Hamilton used last year was on the board. Kids tried to reach the planets by learning addition, subtraction, multiplication and division facts. Each child's space ship was placed in the proper place depending upon their mastery of the facts. Sheila checked children individually with flash cards. The planets were lined up Pluto, Neptune, Uranus, Saturn, Jupiter, Mars, Earth, Venus, Mercury and Sun. If children were working on 0 they started on Pluto. Ms. Hamilton kept a check sheet on all children in all areas to make sure they had finished their work and understood it. Three girls, Erica, Holly and Wendy were practicing their two's. The girls said, "The two's are really easy. It just means we didn't think." Once a week they had a math check-up to place their space ships according to achievement.

The room was quite warm. The air conditioners had not been turned on. Air conditioners had been installed in all PLATO classrooms to keep the terminals at an even temperature. The terminals malfunctioned when overheated. Ms. Hamilton turned the air conditioners on when the kids left the room for music.

Ms. Hamilton was very anxious for PLATO to start. She talked a bit about it, and then corrected papers. She had gone to the wrong school for a PLATO meeting on Wednesday and was sorry about that.

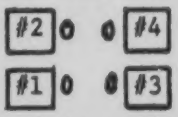
October 6-10, 1975

Teacher's Log: The long awaited day has arrived. We started PLATO. It took two days for everyone to get their 1st session. Since the student teacher is here, I was able to be at the terminals as each child began his first turn.

Many children are not reading directions. They sit for long periods waiting--not noticing the PRESS NEXT. Many are very hesitant to respond--asking if their answer is correct before typing it. Most read the directions slowly, then don't know what to do or worry that they won't do it right. The directions are clear enough--they just aren't thinking or aren't self-confidence enough to try their answer.

When the children look puzzled, I ask them to read the directions again (aloud if necessary) and then they are usually able to tell me what they are supposed to do. If not, I point to the specific instruction and guide them through the steps. Those having the most difficulty were Kate, Beth, and Jon. Peter had difficulty with some words, but caught on quickly. He takes a long time to read directions but is persistent. Ted was delighted, knew exactly what to do, and was quickly into lessons. This is the first time I have seen him really happy. Ann is hesitant, doesn't want to make an error. Rhoda asked a dozen questions--all of which she could answer herself. Billy, Kathy and Sally caught on very fast. Kitty read and questioned everything, but understood what to do and how to do it. Lizzie was quite thorough, asked intelligent questions--is sometimes confused, but once she understands she does a terrific job. Ben, Leslie, Tom, Bob and Martin have good starts. Martin seems to be doing much better than on class work. Sara, Holly, Wendy, Debbie and Shelly are slow getting started--none of them are very enthusiastic about math. Terry and Erica are okay--rather unsure of themselves.

I like being with them on the first session--to spot strengths and weakness, lesson errors, points of confusion, and attitudes. There were almost constant questions. The terminals are arranged thus:



I can stand in the middle and observe all terminals. Children can see what others are doing, discuss common questions and concerns.

Attitudes are all positive.

There was no school Monday, Columbus Day.

Second PLATO sessions took two days. The children are slow to read directions and respond--forget to press "NEXT." After the second session, there was a notable change. Children read and typed faster--the long waits to remember "NEXT" were gone. Thursday and Friday everyone had a complete turn. Children were no longer fretting about the responses prior to typing them. We are off to a good start.

This was the student teacher's last week. I stayed out of the room all morning except during Design Lab on Tuesday when they began quilting project. Each child is to do a square representing an event in Illinois history. When all squares are completed we'll put it together to make a quilt.

Children studied a number line of historic events in Illinois--later arranged events in proper sequence.

We had taken cameras to Springfield and New Salem last week. Each child had the responsibility of photographing specific buildings. This week they have been working in small groups to develop and print their film. Some were blank, some blurred, a few were very good.

October 15, 1975

On the board Ms. Hamilton had written the schedule.

Quiet Reading
Book Reports

Math: X Challenges, MIA, SRA

Spelling Our language mastery
New Salem Information

The children went to their "favorite places" to read until 1:10. Then it was time for book reports. Each child who had read a book gave a report. The children were supposed to listen quietly and be ready to ask questions. The person giving the report was supposed to talk loudly and if he/she didn't, the children raised their hands to indicate that they couldn't hear.

Sara was the first. She read her report very fast and not very loud. The children raised their hands. Sara seemed nervous as she read.

Jon was relaxed, but had a bit of trouble reading his own writing. Ms. Hamilton asked Jon to stop, read it over to himself and then read to the rest of the class because it was hard to follow. Ms. Hamilton asked a child to put his pencil and paper away and give Jon all his attention. She said it was the duty of the audience to keep the chairs quiet. There were questions about the author and the source of the book.

Leslie read her report. The children asked questions about author and source, so Ms. Hamilton said since there was so much interest everyone should include the author and source in their report.

Erica started to read. She was reminded to wait until everyone was ready before she talked about plants.

Holly talked about foals, colts and fillies. She was very verbal and told about many kinds of horses, their characteristics and how they were used. Ms. Hamilton said, "That is a very interesting report, you did an excellent job and gave us a lot of information."

Wendy started to talk very quietly but told many interesting things about the cat family. Her book was about mammals.

After the reports Ms. Hamilton moved the desks around so they weren't so crowded and she started math.

The children were working on pages 68-72 in Mathematics, Learning Systems Texts. Ms. Hamilton worked with the whole group. She said, "Multiplication is a fast way of adding."

Kate was slow to find the page. She didn't seem to follow.

The children read the story "Dirty Digger" which was about a prospector digging for gold. They were looking at patterns and showed how they had to add 10+10+10 and 8+8+8.

Ms. Hamilton noted that the addition could be done a shorter way by multiplication.

She reminded the pupils that they could multiply only when the group members are the same. She asked if they could do this problem 30+24 by multiplication. They said, "No."

They talked about the many ways there are to write ten times six.

10	10		6	6	
x6	10		x10	6	
	10			6	
	10	6 tens		6	10 sixes
	10			6	
	10			6	
				6	
				6	
				6	
				6	

They started a new kind of multiplication where there are two numbers on the top.

18 ft
3 times

Few had done this in the past.

Ms. Hamilton said, "Always start with the number on the bottom and work in a pattern. Multiply in the one's column and then in the ten's column." She showed the children how in:

23
x3
69

it doesn't make much difference which you multiply first in 23 x 3 but in $\begin{array}{r} 18 \\ \times 3 \end{array}$ it does. She said, "You have to do as you do in addition and carry. We can prove that problem. How can we prove it?"

Children came up with: 18+18+18. She said, "18 x 3 means the same. If you're not sure how can you check yourself?" Volunteers said, "addition."

She told them to do a problem on scrap paper or in their heads.

$$\begin{array}{r} 12 \\ \times 6 \end{array}$$

The answers the youngsters got were: 62, 32, 62, 36, 22.

Ms. Hamilton noted that they agreed on the first column but differ on the 10's column. She said, "all right, how can we check it out?" Lizzie wrote on the board:

$$\begin{array}{r} 12 \\ 12 \\ 12 \\ 12 \\ 12 \\ \underline{12} \end{array}$$

Then they said put down 2 and carry 1.

Bob got 72.

Sara didn't say.

Kate went to the bathroom.

Ms. Hamilton went over it: "6 x 2 is 12, put down 2, carry 1. 6 x 1 is 6, plus 1 is 7."

Erica said, "In Mrs. Franklin's class we learned another way." Ms. Hamilton responded, "OK you may use another way. There are other ways." She has them try $\begin{array}{r} 14 \\ \times 7 \end{array}$

Ted got 141, Tom 98. Other answers were: 84, 152, 81 and 88.

Ms. Hamilton said, "I hear a lot of answers. They can't all be right for one problem."

Ms. Hamilton told the children to check on scratch paper. They were to go ahead and work. Nancy wrote on the board. "If you miss the first 2 problems then see me for special help." If you just go up and change your answer, will that help? "No," from her pupils. Ms. Hamilton repeated, "No, see me!"

Child did

$$\begin{array}{r} 14 \\ \times 7 \\ \hline 28 \\ 70 \end{array}$$

7x4 = 28
7x10 = 70

Then the class had a short break.

Bob wanted to take his math book outside to work. Ms. Hamilton said it was pretty windy but he could take it on the steps.

When they went back in the room they continued to work by themselves. Ms. Hamilton used flash cards to test them individually on the multiplication facts.

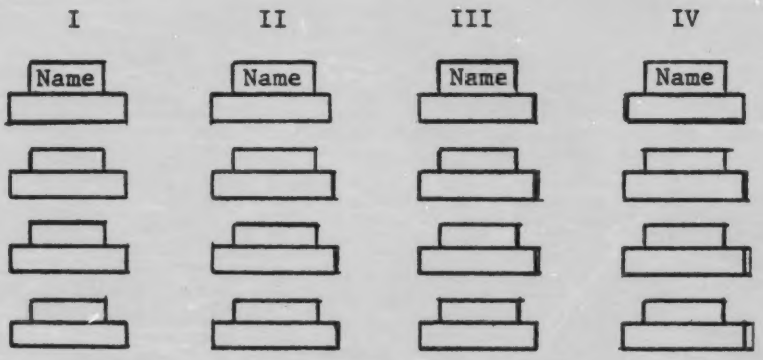
October 20-24

> Teacher's Log: On PLATO, children seem to be generally inaccurate on column addition. I think some of it stems from the finger counting problem--which is still very actively used in addition and subtraction. Jill and Laura are still having the place value problem. They have transferred it from addition to multiplication. Example:
>
> $$\begin{array}{r} 17 \\ \times 2 \\ \hline 61 \end{array}$$
>
> They carry the "4" because it is the <u>largest</u> digit. This problem was apparent when they did EGG FACTORY (Whole Numbers, D28). I think the immediate response will help them become more aware of their errors.

I'm concerned that the children are getting too many new things too fast. I wanted them to be in whole numbers only--until they are comfortable, competent and have some degree of success. Game slot gives them options they are not ready to handle. With inadequate directions (PLATO presumes some previous knowledge) the games become frustration rather than reinforcement and pleasure. This wide choice is great for children who participated last year, but too much for newcomers.

October 23, 1975

Ms. Hamilton had four rows of pockets on a bulletin board, which held the names of the children. When children finished on the terminal they turned their card over and went to get the next child on the list for each terminal.



Ms. Hamilton told the children about leaving a message at the end of a lesson. She said, "if you don't tell me that something has gone wrong, we won't know. You need to tell me and you need to tell PLATO." She emphasized that she may be busy and they may have to wait to tell her, but they should be sure to get to her sometime during the

day. She told children to also write notes when they enjoyed PLATO and to say whether the lesson was too easy or too hard.

She told children they would use the honor system with regard to passwords and not to watch when others put in their passwords.

This morning she asked the children to work on their folders and ask the student teacher for help on anything that was wrong. Ms. Hamilton was going to be orienting children at the terminals. She told them their typing would be slow this morning but by next week they'd be fast.

October 28, 1975

Ms. Hamilton worked with children on projects. The children were making quilt pieces. They had been to the Champaign County Historical Society the day before on a field trip where they had made dolls of corn husks. Some children were weaving, others reading or on PLATO. Ms. Hamilton helped children as they worked on PLATO. When a child had trouble with a terminal that refused to respond, Ms. Hamilton told him/her to turn off the machine and wait two minutes; then turn it on again to see if it was ok. The central computer had been down in the morning. Now the terminal wouldn't respond to the touch.

After library period, three children asked Ms. Hamilton to stay in and work on PLATO rather than go out for recess. Sheila called the fourth child over to see if he wanted to stay in also and finish his session on PLATO. He wanted to do so. The four children worked

intently on the terminals and talked to themselves as they worked. Occasionally they asked each other questions about the lessons. Kathy giggled about EGG DROPPER (Whole Numbers, 2b). Ben asked for help to paint 1/2. He didn't understand all of the directions, and tried to paint it a couple times.

Bob returned to the room and went to the terminal to help another child. Sheila sent him back to his work, making a quilt piece.

Ms. Hamilton said, "Kids have too much trouble with fractions as they haven't had instruction for fractions yet." She did not want the children to have Fractions as a choice until they had had directions for it. She called the children's attention to the CUT AND PAINT (Fractions, A5) choice and told them not to choose it.

It was time for a reading group lesson. Children signed off on PLATO to go to reading. They would finish their PLATO lesson later.

Ms. Hamilton said she helped children for two days to get them started. She explained, "The children last year did not have trouble with fractions as directions were given when it was in the main slot. When it is a game option the kids don't get the same directions."

October 30, 1975

Teacher's Log: Thursday and Friday, Oct. 30 and 31, I was with Don Cohen of CERL in Lexington, Kentucky, for the purpose of demonstrating PLATO at the National Council for Teachers of Math. Although we were placed with commercial

exhibits and had problems with the telephone company getting proper connections, we had a successful trip. To most visitors, PLATO was totally new. If they had heard of it, they assumed it was like "all other teaching machines." I enjoyed acquainting visitors and exhibitors with PLATO's math programs and its stimulating and rewarding affect on children and their growth.

My husband--who was a great skeptic when I first began to work with PLATO--came along for the ride (or rather to take me). He spent part of his time bringing visitors to the terminals and encouraging them to become involved. People were fascinated and came back later to show a friend. Some local math teachers brought their children along--to try PLATO. I "talked" with Howard in Champaign via PLATO--great excitement there!

In regular math, we continue working on x facts. Jeff is the only one to pass. He is working on division. We have discussed and illustrated division arrays (something I started after using PLATO). They understand the relationship to multiplication and division (except Karen and Lori). They continue to practice multiplication computation with weekly reviews of column addition and subtraction where renaming is necessary. Half the class is still making frequent errors in renaming. Subtraction facts are very poor--most of the pupils finger count and not very accurately, at that. They also finger count in addition, but they are quicker and more accurate. These are very difficult habits to break. A few have tried to finger count multiplication facts. I feel that my stress must be on multiplication and division--or we could still be dragging along with subtraction in January. We'll continue weekly reviews and reteaching, but I'll be continually trying to move them forward to new challenges and methods.

November 3-6, 1975

Teacher's Log: We are beginning to receive copies of weekly PLATO data. Several children had difficulty with the Addition Algorithm Check Up. I requested detailed data to study these errors at home. Two or more errors place the child in the "help needed" category.
Billy--2 errors because he is multiplying instead of adding.
Debbie--probably multiplied on 2 problems, neglected to carry on one.
Wendy--still carrying the wrong #.
Kate--carrying and finger counting errors.

Erica--probably put down the wrong # in the 100's column making it 32 instead of 23--then didn't add the carry # to the 1000's column. I don't know what happened to the other problems. She says she did not type the word HUGE. This also happened on one of Jon's--no solution from them or CERL.

Terry--multiplied instead of adding. The other error could be a typing mistake or she could have said 3 x 4 = 12 + 1 (carry #) is 13 and then typed the reverse = 31.

Jon--2 incomplete problems. 1 = "HUGE" as answer.

Lizzie--one incomplete answer, one adding error (careless)

Jon is not doing well on facts--he acts without thinking and makes a lot of errors on paper work.

Those doing especially well are: Ted, Bob, Kitty, Kathy and Rhoda. They are moving rapidly with few errors. Ann and Sally are doing well, but not moving as fast.

No school Friday--parent conferences. I showed each parent a lesson on PLATO. Their comments were very positive, such as: "Now I see why my daughter likes it so much."

"Wendy calls it a fun way to do math."
"I wish I could come to school and use it."
"It makes fractions so easy."
"The kids are always talking about playing on PLATO."
"It's really amazing."

And many other comments--all indicating that the children are talking about it and like using it. I invited each parent to visit and watch as his or her child worked a complete session.

Since this was the completion of a grading period, awards were given. Those who received honors and certificates for passing math fact challenges were:

Addition -	Tom	Debbie	Terry
	Martin	Leslie	Lizzie
	Kathy	Beth	Sara
	Bob	Rhoda	Sally
	Ted	Peter	

Subtraction -	Bob	Rhoda	Sally
	Holly	Lizzie	Ted

Multiplication -	Bob	Rhoda	Lizzie
	Holly	Leslie	Sally
	Ted		

Division - Bob Ted Sally

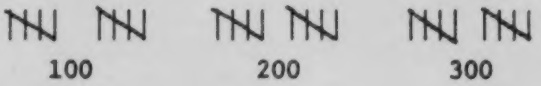
November 10, 1975 (Morning)

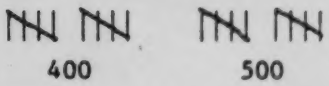
Pupils gathered around Ms. Hamilton looking at pictures of their Springfield trip. One of the children had brought her pictures in to share. Other children were about the room working on weaving or just talking to each other. School had not officially begun. Four children were working at the terminal.

Ms. Hamilton started the math with an old familiar problem on the board. 468 x 8. All the children were invited to try it, except those at terminals. Kathy went to the board to explain as she worked it. She said 8 x 3 = 24, four down here $\begin{array}{r} 463 \\ \times\ 8 \\ \hline 4 \end{array}$ and 2 up here $\begin{array}{r} {\scriptstyle 2} \\ 463 \\ \times\ 8 \\ \hline 4 \end{array}$.

She continued to work the problem in the same manner 8 x 6 + 2 = 50, 0 down here, 5 up here. 8 x 4 + 5 = 37. Kathy finished the problem. Ms. Hamilton reminded the class that you always start with the 8; rather than saying 3 x 8, you say 8 x 3. This helps you make sure that you don't multiply with the wrong number. She also pointed out that you go from the 1's to the 10's and then to the 100's column. Then Shelia gave the children another easy problem. $\begin{array}{r} 23 \\ \times 1 \\ \hline \end{array}$ They did it very quickly. Ms. Hamilton asked them to work another problem in their head. If you have two boxes with 10 pencils in each box, how many pencils do you have? with 3 boxes? with 5 boxes? She wrote on the board as children answered: $\begin{array}{rrr} 2 & 3 & 5 \\ \times 10 & \times 10 & \times 10 \\ \hline \end{array}$ She asked the children what was true of all three problems. They answered that you

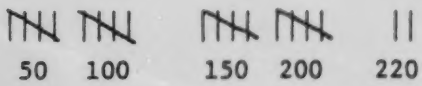
add a zero to the number. Then she asked if it always worked out and they tried 50 x10. To check it out she made marks on the board as they counted to 500 by 10's.





She pointed out there were 50 lines counted 10 for each one, and got 500 so again it worked. Children were repeating with her as they counted.

Next problem: 22 x10 220. Ms. Hamilton asked what they would expect the answer to be. As the children prompted her she wrote:



Then Ms. Hamilton put a group of problems on the board:

25	38	43	87	988
x10	x10	x10	x10	x10

Pupils volunteered the answers. Ted came up with the 9,880. Next problem: 12,345 x10. Here they discussed comma, and she helped them read one hundred twenty three thousand four hundred and fifty. Some of those who were working on PLATO finished. They joined the class discussion. Ms. Hamilton told them not to call anyone else to PLATO until the math discussion was over. Next problem--Ms. Hamilton said, "Let's switch the problem a bit." She wrote on the board:

$$\begin{array}{rrr} 2 & 3 & 5 \\ \underline{\times 20} & \underline{\times 20} & \underline{\times 20} \end{array}$$

They counted 20, 40, 60 etc. Ms. Hamilton asked them how they did it and helped them realize they were taking 2 times 2 plus adding 0. Again she used marks on the board. They worked a couple more problems together:

$$\begin{array}{rr} 25 & 38 \\ \underline{\times 20} & \underline{\times 20} \end{array}$$

Ms. Hamilton had CERL people remove fraction work from the PLATO lessons for her class. She either wanted the directions for fractions or no fractions. She said she hadn't used extra materials that CERL had provided because they were mostly for fractions. Ms. Hall and a Ms. Martin from England came in to see PLATO.

Ms. Hamilton found a way to organize most everything in order to diminish the confusion in the room and to be fair to each person. Rather than raising their hands for help, the children wrote their names on the board when they needed help. Ms. Hamilton attended to the children's requests in the order of names written on the board. Sheila also encouraged independence and self-direction by posting problems and the answers on the bulletin board so children could work out their problems and check to see if they were correst as they worked.

November 10-14, 1975

> Teacher's Log: Our student teacher has started a science unit on the solar system. One of her projects was to determine size comparison of the solar system using a scale the children could visualize. They estimated by rounding off numbers. Then computed planets if the sun had a 12" diameter.

They were quite surprised by the smallness of the planets. They also computed and discussed the distances between planets and from the sun.

Parents are beginning to visit for PLATO sessions. Ben's mother came after school on Wednesday, Holly's mother came Monday, Terry's mother came Wednesday and Debbie's father came Friday. All were truly impressed.

Jon is still doing poorly on basic facts in SPEEDWAY (Whole Numbers, B1). He is working harder on them and improving slowly. He is more interested in being fast than accurate. He is missing 30% on addition and subtraction facts. He likes to do the races and has done more races than most of his classmates.

Sara and Ann are doing especially well in SPEEDWAY. Bob is faster, but makes more errors. All three are doing multiplication and mixed functions. Rhoda and Bob are trying some division with good results.

Holly is making many errors in EGG FACTORS - WITHOUT THE HEN (Whole Numbers, F4). We discussed equations such as $2 \times 3 + 4 \times 1 + 2 \times 5 = ?$. I think the equation should be written: $(2 \times 3) + (4 \times 1) + (2 \times 5) = ?$. It is much clearer and the children have no difficulty understanding it. They frequently used such equations as: $(4 \times 2) - 3 = 5$ and $4 \times (3 - 2) = 4$ last year in HOW THE WEST WAS WON (Whole Numbers, F5) with no confusion. Ben is having the same confusion as Holly with EGG FACTORY - WITHOUT THE HEN (Whole Numbers, F4). Also Sara. I think many more will find it confusing. Kate isn't doing well. I think someone must have been helping her during placement. She has very limited concepts. She is taking home addition and subtraction practice and gets additional help from Title I. She just doesn't understand and most of the time she doesn't try. When she decides to work (which is rare) she does a fair job.

Lizzie, Bob and Ann have finished the first chapter of whole numbers.

No school on Tuesday--Veteran's Day.

November 19, 1975

Don Cohen came in and talked to Sheila for a few minutes about Henry. Don wanted to put Henry on PLATO. "He needs the help." Sheila said, "No." Henry is in a "control" class for PLATO.

Tom's Mother and Kathy's grandfather were observing at the terminals. The student teacher was teaching a lesson on planets. She used slides to show the planets.

An announcement had been made that a balloon ascension was scheduled for the morning. When the time came all kids went out with their teacher to watch. Everyone got very excited as they saw the fire warming up the air to float the balloon. It was a new experience for all. The class came back to the room and had recess. During recess Sheila, Don Cohen and the student teacher were discussing how to figure out the sizes for all planets. They were trying to determine what size to use for Mercury, the smallest planet, so the sun would be in proportion. Sheila tried to get Don to figure it out on PLATO fast. He just kept asking her questions so she'd figure it out herself. She knew how to figure it out but wanted a fast calculation. She decided to use metric measurements. "It's easier."

The children came back in. Ms. Hamilton put some children on the terminals. Two little girls were talking about how neat PLATO is. At the terminal Ms. Hamilton helped Martin with the number accumulator. She explained how you move + or - to get to No. 11.

Four children were weaving. Ted didn't know what to do. Kate and a friend were doing addition flashcards. Three children were writing stories. Two were weaving. Three were making quilt blocks.

On PLATO, Ms. Hamilton had written a note to the folks back at CERL.

"I've had many visitors in to see PLATO today. Parents are

interested in writing letters to keep PLATO in operation. Six parents have visited to watch their children have a full session on PLATO. Hurray! All very positive comments! Sheila."

Tom's mother, who was visiting, said PLATO had increased Tom's interest in math. She was pleased.

November 17-21, 1975

Teacher's Log: Several parents visited again this week: Ann's mother, Sara's father, Ted's father, Bob's mother, Shelly's mother, Billy's mother came after school, both of Sally's parents came after school. All responded very favorably.

The results of fact (x ÷) quizzes were returned from CERL. Kate was present for testing--handed in a blank paper. Pretty low scores--back to working on facts!

One bright ray of sunshine--Ted walked in the room one morning this week and said, "Good morning, Mrs. Hamilton." I couldn't believe my ears. What a delightful surprise! Since then he has spoken the same words each morning--always with the same cheerful tone. Ted communicating with no pressure applied--just like anyone might say it. No matter what happens the rest of the year, I've had my day!

We continue to have confusion with EGG FACTORY - WITHOUT THE HEN. Rhoda, Beth, Tom, and Shelly are added to the list.

Although varied scheduling for individuals is possible, I prefer to concentrate all efforts on whole numbers until at least most of the class has a good basis and frequent successes. I intend to keep PLATO a part of my math program rather than a "do what you want" extra. With my reinforcing PLATO activities, PLATO reinforcing basic facts and computation, I feel that a better job will result.

Ben, Terry, Leslie, Ted, Sara, Billy, Erica, Kitty, Holly, Kathy, Beth, Rhoda, Sally and Peter completed Chapter 1 of Whole Numbers this week.

Kate, Beth, Debbie, Martin, Tom and Shelly are still working on the first chapter.

The surprises are Ben, Billy and Ted. Although always among the last to complete assignments, they are not lagging on PLATO.

November 24-26, 1975

Teacher's Log: This is a short week due to Thanksgiving vacation. All except Kate and Martin have completed the first chapter of WHOLE NUMBERS. Martin is just as slow in his classwork--often doesn't understand, but will not ask for help. He exerts the least effort possible, but when kept after school he gets down to business. Kate is taking more and more work home--does better all the time on class work. I think a lot of this is due to pressure from Mother. Since Mother doesn't press about PLATO--no papers to go home, it is the one area she doesn't feel she "has to do." Also her PLATO is usually when I am working with a reading group and not available to give assistance. She gets help from friends, but it is more giving answers--or very strong hints--instead of making her think.

Terry is having trouble with subtraction and multiplication computation. She is poor on subtraction facts and doesn't recognize word problems that require subtraction.

Beth has tried division facts in SPEEDWAY. She really doesn't know any facts well. She got addition by counting fast on the 1st class quiz. I'm sure she could have passed the timed individual quiz. Beth is very inconsistent in work. The learning disabilities teacher feels that she has skills required for her dismissal from the program. The problem is that she doesn't apply these skills. We are putting her on a schedule to be determined by her performance. When she follows through with assignments and projects Monday-Thursday, she may stay in the classroom on Friday. This appeals to her so we are hopeful that she will show more thought and care in doing her work.

Jon has been released from Title I spelling help. He gets no more than one error on each test. He still goes for work with facts. We hope to stop at Christmas time.

Ted continues his cherry, "Good morning, Mrs. Hamilton." What a lovely way to start each day!

December 8-12, 1975

Teacher's Log: Results from addition and subtraction of fractions tests were returned this week. The fact test results are just another copy of that given earlier--results already inserted.

Jon is trying division on SPEEDWAY, but doesn't know the facts well enough to have much success.

Peter completed the instruction on the subtraction algorithm. He is still making a lot of errors. He doesn't know facts and has trouble remembering how to rename. This is his first real weakness on PLATO math.

Ben, Tom and Sally have completed the second whole number chapter. Of course, Sally's progress is no surprise, but for Ben and Tom to be among the 1st eight to complete anything is an accomplishment. I feel it shows how highly motivated they are to use PLATO. I've tried so many techniques to inspire them--nothing else has been really effective.

Kate has improved on subtraction concepts, but is doing poorly on subtraction algorithm. We go over and over methods, but she doesn't get it yet.

Terry is doing better in addition and subtraction concepts and algorithms. She tries to help Kate and in the process is doing better herself. She is a hard worker and wants to do well. She and Kate often work on facts together.

In regular math, we are continuing multiplication computation skills with our usual weekly review of addition and subtraction.

January 27, 1976

Ms. Hamilton was helping individual children with work for their folders as the class worked at their desks. Their assignments were: Math Progress Check, Mathematics for Individual Achievement Test, pp. 126-128 and Claim Game (on paper). Ms. Hamilton helped Sara with papers in her folder. Ted sat at a table and worken on a science report. Bob and Kate were working on papers in their folders. Kate was correcting division problems that she had missed.

Four children were at the PLATO terminals. Rhoda went to get a string in order to work the string problems.

February 2-6, 1976

> Teacher's Log: The other stumbling block in Meaning of Fractions is STICKS "N" STRING (Fractions, A9). I think that is in the lesson. I even find it difficult to be accurate. Most of the children don't go get the string--they guess. Well it is just too hard to guess. I did it by folding paper. Even that wasn't easy, but it was a lot better than string which is hard to hold and sometimes stretches.

March 8, 1976

Ms. Hamilton helped children make Munchkin Flowers for the Wizard of Oz Performance March 25. Sets for the play were being built by other children. Some children worked on math worksheets and went to Ms. Hamilton to have their progress checked off in her log. Terry was helping Kate on PLATO with fractions. Kate had been in a "give up" mood.

March 17, 1976

Ms. Hamilton was very pleased with the fractions worksheets. "They are beautiful worksheets." Children were working on the worksheets: NUMBER LINE, TRY THESE, MIXED NUMBERS, FRACTION WHOLE NUMBERS, PIZZA AND FUNNY FACES.

The children practiced for the Wizard of Oz. The show was going great. The children helped make a corn field, apple orchard etc., and designed many of the costumes. Kate was Aunt Em, Bob was the scarecrow, Sara was one of the Munchkins and Ted the Narrator.

Ms. Hamilton had been helping Kate with Math after school for 2 weeks. Ms. Hamilton said Kate had improved.

All the children had passed their multiplication, division, subtraction and addition facts except Beth, Ben, Kate, Billy and Peter.

March 25, 1976

Ms. Hamilton was painting kids' faces for the Wizard of Oz performance. Children were milling around the room getting dressed and observing others. Four children were at the terminal. Ms. Hamilton said the children didn't want to lose their turn for the day. Witches and Munchkins sat at the terminals and discussed PLATO lessons and games while waiting for the play to begin. Sara helped Wendy with fractions on PLATO. Ted was concerned with the number of minutes until the play would begin.

The Wizard of Oz was performed on the stage in the auditorium. Children played their parts well. Teachers thought the music and sets were excellent and the audience of children and teachers showed great appreciation.

April 5-9, 1976

> Teacher's Log: This was the second week in study of the linear metric system. The children have done a lot of independent measuring objects in the room or hall, etc.

April 13, 1976

The children had a bake sale to study money and banking. They

went to other rooms and took orders for cookies, popcorn, etc. and then prepared the food and took it to school. While some children worked with their folders, others were bagging, labeling and marking cookies with the Student Teacher. The children kept a record of the cookies bagged. They decided to sell 3 cookies for 25¢. The children had 52 orders for popcorn. When the orders were brought, they went to each room to deliver them and made change. The student teacher had the children role-play in order to test their readiness to do business in other rooms. Children who were poorest at making change were paired with those who were good. Ms. Hamilton had discussed the value of coins with the children. They had manipulated the money, figured out different ways to make 37¢. Children had worked together using paper money and fake coins to make up different amounts of money using the least number of coins. Ms. Hamilton said they had discussed how to present the Bake Sale to kids in other rooms. The children kept track of the cost of ingredients and time spent in order to figure out profits.

From this small business venture, the children went on to study banking and visited Busey Bank. They learned how to write checks and also learned something about stocks.

Ms. Hamilton made up a chart of children's errors in fractions. She checked the specific problems each child had trouble with and helped the child accordingly. Equivalent fractions were difficult for the children.

May 17, 1976

Children worked on folder materials and then went to the design lab. After design lab, they went to the school library to hear stories. After library the children worked on PLATO worksheets. There were no pupils on terminals so Ms. Hamilton said, "There are four terminals with no one on. I told you whoever's turn it was on PLATO could go on." She directed four children to the terminals.

Ms. Hamilton conducted a tournament on number facts. She said the same rules as yesterday would apply; accept only the first answer, say it once and if there's a tie go through again. She selected opponents randomly. It seemed to work as well as trying to match according to ability as she had done last year. Ann and Martin were competing on subtraction facts--then others did so.

Ms. Hamilton had her own way of teaching math. She said, "I don't use text books too much. They don't stress what I want to stress when I want to stress it." She used the books for some ideas and exercises. Ms. Hamilton also picked up a lot of ideas for teaching from PLATO. She liked the fractions strand the best as it was consistent with the way she taught math. In whole numbers, Ms. Hamilton did not use many manipulative materials. She said, "I stress the skills. I don't feel comfortable with manipulatives. It drives me crazy to have toys all around the room." Sheila said, "the whole numbers strand exposed me to a lot of methods in explaining to children who don't have good concepts. Things I had never used before." Ms. Hamilton didn't get to graphs on PLATO this year. She said, "From playing

battleship the children were able to get the coordinates. I did a little correlating." Sheila had many worksheets that she had used the year before when she learned to teach graphs. She used some of those worksheets the year 75-76 but said she spent only about 3% of her math time on graphs. She said, "I wish that I had another month of school to teach graphs. I could have helped the children a lot better this year in graphs."

When asked, "If you could choose between PLATO and a teacher aide in your room, which would it be?" Sheila answered, "PLATO." She didn't hesitate to make the choice and went on to say, "I think more children profit from PLATO than from a teacher aide. I think they learn things that an aide cannot teach such as concentration, skim reading which is a very difficult thing to get kids to do, they learn to pace themselves, to be intently involved. The trouble with one to one with a teacher is the students become so dependent and I think they become independent with PLATO. I have to balance that to say there are times when a teacher has to help at the terminal."

STUDENT ACHIEVEMENT--TWO YEARS IN ONE?

During the second of these two years Ms. Hamilton came to know the strengths and weaknesses of PLATO for teaching fourth grade arithmetic. It was a personal accomplishment for her. She was treated well by the CERL people and even became a part of the demonstration team at a professional meeting in Kentucky. She was caught up in the CERL enthusiasm. She continued to extoll the virtues of PLATO, "I think PLATO is great! I hope to remain in the program. . . I wish that more children could have use of the terminals."

And her students. They never missed a turn. Sara said, "I want to go into Mr. Kalisch next year cause he has PLATO." Ted said, "PLATO is better than regular math. I like PLATO 'cause you get to play a lot of games." Kate said, "I likes games on PLATO because you can get a friend to play with you."

And the rest of the youngsters said the same. Even as spring came to Johnson School, and recess brought the blossom-rich air to their lungs, these children kept banging away at BATTLESHIP (Graphs, 1b) and sorting away at SORT EQUIVALENT NUMBERS (Fractions, C15). In terms of time-on-task, the children of this class had more than double the experience pupils ordinarily get on arithmetic problems, without apparently sacrificing time for reading, social studies or aesthetics lessons. According to Ms. Hamilton, "Beside just math skills, PLATO teaches math concepts, reading skills, spelling and writing. Children try to make their notes more sensible on PLATO. What they get out of PLATO is just tremendous."

Sheila knew that PLATO often "CROAKED." She knew that the software was not available for the rest of elementary school math. She knew that her district could not afford to buy terminals. But it was hard for her to think of these as weaknesses. That's just the way PLATO was.

There are teachers more delimiting in their definition of fourth grade arithmetic than Sheila Hamilton and Don Cohen. Most would accept fractions, decimals, and graphs to go with the basic operations, but some would not include EGG DROP or a student's own creation of SPACE SPIDER. Some would be uncomfortable about counting help given to another child (doing a simpler lesson) as time-on-task. A lot of time was spent in writing notes to the authors. What part of this is mathematics?

Not even Don Cohen would go so far to say that all the world is mathematics. But clearly within his definition, and that of Bob Davis and the other CERL people, learning mathematics is a matter of incorporating the basic concepts and operations into everyday living. Learning is a matter of experience, much more than of performance. It is a matter of thinking, more than of calculating. The calculating and performance are important, but only if made meaningful. On PLATO the children found fractions in pizzas and algebra in frontier trains. They found an even better "tube" than the one they had at home, one that they could talk to and that would talk back to them, and help them learn their lessons.

What socialization here! They wanted to learn. The work ethic

runs wild. Sara said, "I learned lots of addition and subtraction. I started on Chapter 1. Now I'm on Chapter 8. I finished it and I was so happy. Chapter 8 is adding and subtracting mixed numbers. I was so happy to get decimals." Ted said, "I'm on level 10 of 12." He continued in the lesson to level 11 and said, "Now if I can get here, I can probably pass." He finished 12 of 12 and said, "Oh boy, I finished EQUIVALENT FRACTIONS GENERALIZED." Kate said, "I likes PLATO lessons because it helps me learn multiplication, division, subtraction and addition."

These were the children Sheila Hamilton was teaching to be responsible. PLATO gave them an instrument, a space of their own (for like King Tut's tomb, it was not the teacher's space) for exercising teacher-like, parent-like control of time, movement, and subject matter, without giving up the opportunity to have fun. It was a field day in responsibility.

It was as if they would race to maturity, two years in one, except that the hard work was all so much fun.

PLATO was not there to give them lessons in adulthood, but in mathematics. Did they learn a year's worth? Ms. Hamilton said, "Children learned to concentrate. They became very proud of the successes they had. I feel they learned to try not so much in relation to others, but in relation to their own progress. They looked in the chapters to see how they were progressing." Every child learned on PLATO, even those who didn't like math. The test scores show they gained, on the average, over two years per child. The test

scores shown on the next page are from the Comprehensive Test of Basic Skills. These tests do not conform particularly to the PLATO curriculum and they are more narrow than most people would want an arithmetic program to be, but they do give some indication that certain common problems can be worked well by Ms. Hamilton's pupils.

The tests were administered the second school week in the fall and again with about three weeks to go in the spring. It is known that average children often appear to gain more than a year during this span, but a median gain of 2.2 years is clearly better than the average. Even the two most poorly achieving children, one of whom was Kate, advanced on these test-scales well over a year's growth, and stood only slightly below the national norm for fourth grade children.

But the most important PLATO achievement of all is not in long division, nor in attention to directions, nor in typing, nor in gamesmanship, nor in socialization, but in enthusiasm for learning mathematics. Sara did not want to do her sixes, but at the end of the year she was ready and eager for percentage. Kate was still getting nowhere with fractions, but she knew that PLATO could help her learn. And Ted was finishing assignments in math, and in social studies as well.

PLATO can teach, and children do learn. The children were happy. The parents and grandparents were happy. PLATO was clearly a success in Ms. Hamilton's fourth grade room.

Sheila Hamilton Grade 4
Johnson School on 9/5/75

		Computation		Concepts		Application		Total	
Tom	4th	31	4.9	23	6.8	11	5.3	65	5.4
Martin	4th	17	3.4	10	3.3	7	4.0	34	3.4
Billy	4th	15	3.1	17	4.9	7	4.0	39	3.8
Kathy	4th	37	5.7	21	6.0	17	8.2	75	6.3
Ben	4th	20	3.7	10	4.1	10	5.0	43	4.1
Jon	4th	24	4.1	11	3.5	10	5.0	45	4.2
Bob	4th	40	6.4	21	6.0	17	8.2	78	6.6
Debbie	4th	26	4.3	13	4.1	8	4.4	47	4.3
Leslie	4th	21	3.8	14	4.3	8	4.4	43	4.1
Beth	4th	18	3.5	5	1.9	7	4.0	30	3.0
Erica	4th	23	4.0	20	5.6	10	5.0	53	4.6
Holly	4th	21	3.8	16	4.7	7	4.0	44	4.1
Rhoda	4th	32	5.0	19	5.4	18	8.9	69	5.7
Terry	4th	20	3.7	16	4.7	4	2.7	40	3.9
Wendy	4th	27	4.4	12	3.8	8	4.4	47	4.3
Mona	4th	34	5.3	26	7.8	16	7.5	76	6.4
Beth	4th	31	4.9	27	8.4	16	7.5	74	6.2
Sara	4th	22	3.9	12	3.8	8	4.4	42	4.0
Kitty	4th	29	4.7	26	7.8	11	5.3	66	5.5
Kate	4th	12	2.8	4	1.6	4	2.7	20	2.1
Sally	4th	30	4.8	22	6.4	12	5.6	64	5.3
Shelly	4th	17	3.4	14	4.3	12	5.6	43	4.1
Kenneth	4th	11	2.7	13	4.1	5	3.2	29	3.0
Ted	4th	14	3.0	9	3.1	9	4.7	32	3.2

Each column has raw score and
corresponding grade equivalent

Md = 4.1

Sheila Hamilton Grade 4
Johnson School on 4/30/76

		Computation		Concepts		Application		Total	
Tom	4th	38	5.9	27	8.4	15	6.9	80	6.9
Martin	4th	33	5.2	18	5.1	12	5.6	68	5.2
Billy	4th	36	5.6	25	7.4	16	7.5	77	6.5
Kathy	4th	45	8.6	28	8.9	17	8.2	90	8.5
Ben	4th	35	5.4	25	7.4	8	4.4	68	5.6
Jon	4th	41	6.6	21	6.0	10	5.0	72	6.0
Bob	4th	43	7.6	24	7.1	18	8.9	85	7.6
Debbie	4th	39	6.1	24	7.1	12	5.6	75	6.3
Leslie	4th	38	5.9	18	5.1	6	3.6	62	5.2
Beth	4th	28	4.5	12	3.8	5	3.2	45	4.2
Erica	4th	38	5.9	20	5.6	15	6.9	73	6.1
Holly	4th	42	7.1	15	4.5	6	3.6	63	5.2
Rhoda	4th	40	6.4	24	7.1	18	8.9	82	7.1
Terry	4th	39	6.1	21	6.0	8	4.4	68	5.6
Wendy	4th	42	7.1	23	6.8	11	5.3	76	6.4
Mona	4th	45	8.6	29	9.5	19	9.8	93	9.2
Beth	4th	45	8.6	28	8.9	20	11.1	93	9.2
Sara	4th	41	6.6	29	9.5	18	8.9	88	8.1
Kitty	4th	Ø	***	Ø	***	Ø	***	Ø	***
Kate	4th	37	5.7	4	1.6	5	3.2	46	4.2
Sally	4th	Ø	***	Ø	***	Ø	***	Ø	***
Shelly	4th	30	4.8	23	6.8	15	6.9	68	5.6
Kenneth	4th	36	5.6	15	4.5	10	5.0	61	5.1
Ted	4th	40	6.4	25	7.4	15	6.9	80	6.9

Each column has raw score and
corresponding grade equivalent

Md 6.35

HUMANISM IN EDUCATION. . .WOULD PLATO CONTRIBUTE?

The prospect of using computer technology to teach raises hopes as well as fears in the minds of educators. The potential is great, but is 1984 becoming a reality? Could machines replace teachers and regiment classrooms? "Not here," say proponents of the PLATO computer-aided instruction system at the University of Illinois. Others are more skeptical.

Technological systems are a part of our culture. Applications of technology through the use of computers to aid instruction was steadily increasing until the 1970's, school budgets became greatly curtailed. It is reasonable to suppose that another wave of computer-aided instruction is on the way. Will technology come to the classroom only to diminish humanism in teaching? Are there ways of increasing the chances that educators will be responsive to the challenge of using computers in a humane way?

It is difficult to define what a humanistic way of using computers is, but the definition should include emphasis on individual action, thought and feeling. What does it mean "to have a good day" on PLATO? Could it mean that the technology has been used in a humanistic way? Could it mean that the child's nature is brought forth? Could it mean that children are indeed challenged to expand their capabilities? Or does it mean that the child was entertained?

A good day in school would be one in which the child enjoys, yet increases some aspects of understanding. Some questions

we might consider when evaluating the use of PLATO, or any instructional system are:

1. Is there a proper balance between the encouragement of student valuing and community values?
2. Are earlier student responses utilized in selecting or creating subsequent lessons?
3. Are opportunities provided for broadening one's repertoire of cognitive and affective experiences?
4. Are opportunities provided for challenge and success?
5. Are opportunities provided for personal responsibility in solving problems?
6. Are opportunities provided to make mistakes with acceptance of those mistakes as natural and free of incrimination?
7. Does the child have opportunities to do sustained work independent of help and interference of teachers and other students?
8. Are there opportunities and encouragements for creative acts?
9. Are there opportunities for sharing ideas and knowing others experiences and values?

The instructional programming in elementary school mathematics on PLATO scores well on these criteria.

To know the workplace inside CERL is to know a human place. The developers of the materials were expert and experienced in elementary school classroom teaching. Among them, ideas flowed in all directions, and in the most personal of ways.

The director, Bob Davis, had published mathematics textbooks, taught teachers and children, and had researched children's thinking in mathematics. The authors had experience varying from master elementary teaching to college teaching. The CERL work spaces were the blend of teaching experience, humanistic philosophy, and concern for children. One would expect lesson materials that score well on the nine points.

But mechanistic devices sometimes spring from the hands of poets. What of the materials themselves? What of the learning climate built up around the terminals? What of the behavior of the children during and after instruction? Much of this case study testifies to the personalistic exchange between PLATO and the youngsters. It has documented the creative responses which were evoked.

It has also documented that the spirit of competition was strong around Ms. Hamilton's PLATO. Competition can run roughshod over humanism. There were struggles to win. There were cries of "Hit 'em" and "I'm the mad bomber." Whether or not these are subtle exercises for more serious hostilities is a matter to ponder. Harmful effects were not apparent here. The competition appeared to be benign.

The PLATO math materials do not directly celebrate the efforts of mathematicians and other scholars as humans, yet they do honor the responses of children as work that will add to scholarly and individualistic accomplishment. Every child believed it.

Once given, a student's answers become part of the further lesson. Authors of all strands--graphs, whole numbers and fractions--

attempted to structure lessons so that a child procedes when he/she is ready to do so without repeating work already mastered. The fractions strand was especially designed to provide the child with information regarding level and type of mastery. Children were told by PLATO what they had mastered and what they still had to do to complete each curriculum chapter.

In many of the lessons, making mistakes was the rule rather than the excepction. Children who were embarrassed by mistakes when they started to use PLATO later became accustomed to mistakes as part of the process of figuring out problems. The lessons are programmed to expect a range of incorrect and correct student responses. Children are directed in such a way that they feel responsible and are challenged to solve each problem. The study of Sara shows how she used the PLATO terminal to make mistakes and eventually succeed. She didn't need to sit by the teacher as before. She became independent from the teacher.

Personal valuing seems to be a most central part of the curriculum. An underlying assumption of the graphs and whole numbers strands is that children's ideas are a resource. Children are encouraged to create their own problems. Special lessons, YOUR WAY (Whole Numbers, F14) and EXPERIMENTING WITH LINEAR GRAPHS (Graphs, 1.0), call for a child's own creations. As an example of valuing children's responses, the authors in the graph strand accepted the answers that the children gave by plotting their answers on the screen. The lesson, SLOPE CHECK-UP (Graphs, 1k), is an example. The authors tried to anticipate what errors would be made and programmed PLATO to show these errors as

correct answers to a different problem. The authors said, "children often are answering some other problem correctly, one that makes more sense to them. One of the PLATO curriculum developer's jobs is to predict those other problems."

Easley and Zwoyer (1975) have shown how students cope in school using trusted schemes tempered by experience and superstition. Some are inappropriate. But tenacious pupils who have a large supply of schemes manage to get by because sooner or later even a wrong scheme will get the right answer. Others give up trying. Students using PLATO have opportunities to understand the relationship between their scheme and PLATO's--errors get rather careful attention.

Case (1975) and others have argued that children gain a better understanding of the principles of mathematics when the learner's errors and justifications as well as correct answers receive attention. If true, it gives focus to what is simultaneously a strength and a weakness of CAI systems such as PLATO. PLATO cannot anticipate all of the child's wrong answers, but it can often pay more attention to each individual child than a busy teacher can. The computer does not have the capacity of an ordinary teacher to analyze wrong answers. When neither machine nor human understands the child's obstacle the distress can be great. When used optimally PLATO and a competent teacher can do better than either alone. Paying attention to the child's thoughts and responses shows concern for the child. PLATO reacts to many responses but cannot cope with distress in the way a competent teacher can.

PLATO brings many opportunities to increase the repertoire of cognitive and affective experiences. Lessons have been designed to promote the academic abilities of the children. At the same time children are learning to multiply they are learning to respond to calls for help from students nearby. At least in this classroom, school becomes slightly more a matter of working out problems together. PLATO encourages children to find a friend to play a game. Time on PLATO is precious so when a child needs help and the teacher is busy, other children help. A teacher who ordinarily requires children "to do their own work" encourages PLATO learners to help each other on the terminal. PLATO had a special library section where children could look at other children's work for ideas on how to solve problems. Two examples were: NAMES FOR TODAY'S DATE (Whole Numbers, F1) and PAINTINGS LIBRARY (Fractions, A8).

Bruce Hicks and Gordon Hoke (1974) have written:

> Computers challenge society. They can confer benefits or just regiment us. They can serve the many or just the few.

Hoke and Hicks went on to ask:

> What are the roles and responsibilities of each educator in helping to insure that computers assist education, but in a humane and humanistic way?

The elementary mathematics lessons on PLATO were more humanistic than most mathematics lessons because they saluted individualistic expression and drew learner attention to the implication of their acts. The space around PLATO was marked by challenge, but also by succor. Competition was usually in the air. The sense of accomplishment endured from session to session.

It was a paradox. At least as used in Ms. Hamilton's room, PLATO individualized the study of mathematics, yet made it possible for children to be more aware of what other children were struggling to learn and how they dealt with their obstacles. It just did not have a 1984 aura about it.

STUDENT COMMENTS ON PLATO - ELECTRONIC GRAPHITI

The children's notes on PLATO were a rich source of information on children's attitudes and difficulties at the terminals. Children took PLATO's invitation to express, HOW I FEEL TODAY.

The terminal served as a communication system, a friend to listen to the child's worries, frustrations and joys. Children used the terminal to say they were angry, to say they had fun, to request more games, to make suggestions to PLATO, to ask for help. In general they carried on conversations and communicated as if with a person who was interested in them. They loved PLATO, they hated PLATO, they thought PLATO was clever and dumb, but they never stopped wanting to be on PLATO.

Teachers and CERL people used the terminal to respond to children's thoughts. The adults found the notes helpful in the continuing development of lessons.

CHILDREN LIKE PLATO - THINK IT'S FUN

. . . . KITTY N . . . .

DEAR PLATO, I THOUGHT MR. MATH WAS A NEAT IDEA. WHO GETS
ALL THE IDEAS FOR PLATO / BYE-BYE FOR NOW.
YOURS,
KITTY N

. . . . LIZZIE L . . . .

LESSON PICO-FOMI
MODULE MULT. TECHNIQUES AND SUBTRACTION-1

PLATO THAT LESSON WAS NOT TOO HARD AND NOT TOO EASY FOR ME
I REALY LIKE THAT.

. . . . DEBBIE D . . . .

DEAR PLATO, I LIKE THE GAMES YOU PLAY.
BUT NOW I HAVE TO GO.

. . . . KITTY N . . . .

DEAR PLATO, THIS WAS A VERY NICE SESSION. NOT TO HARD
OR TO EASY. I AM GLAD SOME-ONE WAS ABLE TO INVENT YOU.

. . . . SALLY R . . . .

I HAD A FUN TIME ON PLATO TODAY. I LIKED IT VERY MUCH.

DEAR PLATO I THINK MY TEARN IS FUN THANK FOR PLATO I LIKE
IT IT IS FUN.

. . . . BILLY B . . . .

LESSON HOW THE WEST WAS ONE
MODULE MULT. TECHNIQUES AND SUBTRACTION-1

7 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6
I T W A S F U N . B U
T E A S Y
6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6

. . . . SALLY R . . . .

DEAR PLATO.
IHAD FUN TODAY. I SAW I DONT KNOW HOW MANY BUT
I SAW ALOT CCCCMCMCMCMMMMMMMC X M P

DEAR PLATO, TODAY I HAD FUN. I SAW ALOT OF LESSONS
AND I HAD FUN. SALLY RODGERS
AND AS YOU KNOW TURTLE

. . . . DEBBIE . . . .

H E L
HELLO. TODAY I HAD A GOOD LESSON. I PLAYED 1 GAME,2
MAIN. IT WAS FUN. I WILL BE ON PLATO TOMARROW.
BYE PLATO

. . . . LESLIE E . . . .

DEAR PLATO.
I LIKE PLATO ALOT.
I LIKE EVERY CHAPTER THERE FUN.
YOUR FRIEND LESLIE E (BEAVER).

DEAR BONNIE. I ALWAYS HAVE
FUN ON PLATO
IT IS FUN.
LESLIE D (BEAVER)

. . . . HOLLY . . . .

DEAR PLATO
I LIKE YOU. YOU ARE
FUN

. . . . ANN L . . . .

LESSON OBSTACLE COURSE
MODULE MEANING OF DECIMAL FRACTIONS

DEAR PLATO,
I LIKE TO MAKE GUESSES
YOURS TRULY ANN L

. . . . SALLY R . . . .

LESSON RECRATING AT THE EGG FACTORY
MODULE DIVISION MEANINGS / MULT ALGORITHM

DEAR PLATO
TODAY I HAD FUN PLAYING WHAT I DID. I THINK I
HAD THE RIGHT AMOUNT OF TIME
SALLY R

. . . . TOM A . . . .

HI THERE PLATO HOW ARE YOU TODAY

CHILDREN DON'T LIKE PLATO - SHOW ANGER

. . . . MARTIN A . . . .

I THINK THAT THE HOCKY GAME IS FULL OF SHIT.

. . . . HOLLY F . . . .

YOU ARE A PIFFLE YOU GAVE ME
SEVEN MIN. YOU CREAP

. . . . SALLY R . . . .

DEAR PLATO I HAVENT GOT TO DO ANYTHING DIFFERENT TODAY.
THAT MAKES ME ANGRY.

. . . . MARTIN A . . . .

I THINK THAT PICO-FOMI STUPID

HOW THE WEST WAS WON IS DUMB
QQ
QQ
Q

TORPETO IS DUMB

WHAT HAPPED TO MY GAME SLOT

. . . . PETER S . . . .

I WHAT YOU DUMYS I HAET YOU

. . . . TOM A . . . .

LESSON BOXES : NAME EQUIVALENT FRACTIONS
MODULE EQUIVALENT FRACTIONS

YOUR LESSON SEEMS IMPOSSIBLE

. . . . BRIAN C . . . .

TORPEDO IS DOMB AND CRAZY.

. . . . SHELLY S . . . .

DEAR PLATO
WOULD YOU PLEASE NOT GIVE ME DARTS I DO NOT LIKE IT
IT IS DUMB.
YOURS SHELLY S

DEAR PLATO WOULD YOU NOT GIVE ME MISSION INPOSSAL
IT,S IS DUMB
SHELLY S

. . . . PETER S . . . .

LESSON EQUIVALENT FRACTIONS GENERALIZED
MODULE EQUIVALENT FRACTIONS

THIS LISEN
IS DUM I DON,T SEE Y . THAT IS WON OF THE COMENTS IN,Y WAY
IT GET,S ME SICK IA

. . . . JON C . . . .

HORES RACS IS A DOG AND THE PEPOLE WHO MADE IT IS TO.

. . . . BOB C . . . .

I DIDNT GET A GAMES SLOT TODAY EI
THER AND I HATE THOSE STUPID LESS
ONS.....

C H E A T E R

. . . . SHELLY S . . . .

LESSON EGG FACTORY WITHOUT THE HEN-PART 2
MODULE MORE MULT. AND SUB. TECHNIQUES

DEAR PLATO I DO NOT LIKE THE LESSON I WAS JUST IN.
IT,S TOO EASY. IT,S TOO DUMB. THE LESSON I WAS EGG

CHILDREN WANT MORE GAMES - MORE TIME

. . . . RHODA F . . . .

SOMETIME GIVE ME A LONGER
TIME

. . . . ERICA D . . . .

I WANT MORE TIME ON PLATO
I WANT TO PLAY SPEEDWAY

. . . . SALLY R . . . .

THIS AINT FAIR I DIDNT GET ENOUGH TIME PETER S SAID THAT
TOO.

. . . . ERICA D . . . .

I WISH I COULD HAVE MORE TIME ON PLATO NEXT TIME
1,
Q11QW2
Q2222

. . . . BOB C . . . .
I THINK YOU BETTER GET SOME BETTER GAMES SLOT.
P.S. THE BOB C
THE GREAT.

. . . . BILLY B . . . .

I DID NOT GET TO FINISH (OR EVEN START) THE LESSON
I CHOSE (TORPEDOW) . . . . . .
. . . . . .
. . . . . .

. . . . ERICA D . . . .

HOW THE WEST WAS WON IS NOT FARE.
I DEMAND MORE TIME ON PLATO.
I WISH I COULD HAVE MORE TIME IN GAME SLOT.

. . . . BRIAN C . . . .

PLATO IS CRAZY.
AND THAY DON,T GIVE LOTS OF TIME.

. . . . BEN D . . . .

I WANT A BIG GAME SLOT . . . . . .
. . . . . .
FROM BEN D

. . . . LIZZIE LEE . . . .

PLATO. I WOULD LIKE YOU TO KEEP OBSTACLE COURSE IN GAME SLOT. I DID NOT GET TO TRY IT TODAY, BUT IT LOOKS LIKE FUN.
YOURS TRULY
LIZZIE LEE

DEAR PLATO, THANK YOU, FOR KEEPING OBSTICLE COURSE IN GAME SLOT (I AM SORRY ABOUT NOT THANKING YOU SOONER) BUT I THINK THE GAME IS TO FAST FOR ME. I DO NOT LIKE IT ANY MORE. LIZZIE LEE

. . . . WENDY K . . . .

I THINK I SHOULD GET MY GAME
SLOT . . . . . .

. . . . TOM A . . . .

WOULD YOU GIVE MORE GAMES

. . . . BOB C . . . .

HOW COME I GET ALL THOSE DUMB CHE
CKUPS AND NO GAMES SLOT . . . . . .
. . . . . .
. . . . . .

. . . . PETER S . . . .

I WANT A GAME SLOT BOO HOO

CHILDREN MAKE SUGGESTIONS - QUESTION THE
LESSON - POINT OUT ERRORS

. . . . KITTY N . . . .

DEAR PLATO, WHAT WAS THE ERROR IN THE LESSON I JUST
FINISHED / IS MY TIME UP / GOOD-BYE, BYE-BYE. SE YOU

DEAR PLATO, THE REASON I DID NOT WIN HOCKEY WAS BECAUSE
I FORGOT THE NUMBERS FOR THE ANGLES. I THINK YOU SHOULD
KEEP THE NUMBERS FOR THE ANGLES IN SIGHT.

DEAR PLATO, WHY IS IT SOME TIMES YOU GIVE ME VERY SHORT
LESSONS /LIKE JUST NOW YOU GAVE ME A LESSON THAT LASTED
ABOUT 2 MINUTES. KITTY N

DEAR PLATO, IN HOP GAME, PLATO ALWAS GETS TO BE
THE BUNNY. I WOULD LIKE TO BE THE BUNNY.
SO-LONG,
KITTY N

. . . . BEN D . . . .

LESSON TORPEDO
MODULE MIXED NUMBERS AND FRACTIONS > 1

DEAR PLATO,
WHY DOES PLATO GET
MESSED UP A LOT /
FROM COOL CAT.

. . . . BILLY B . . . .

LESSON EQUIVALENT FRACTIONS GENERALIZED
MODULE EQUIVALENT FRACTIONS

I WAS IN LEVEL 3 AND THEN IT SAID
LEVEL 1
((*(*(*(*(*9*(*(*(*(*(*(*(*(898998*(*(*(*(*(*(*(****(((
6 7*(* 6 U 6 R T X C V G H U UY:IHIUHJHKBLHBLFGJGLYGLYGKGK

. . . . ERICA D . . . .

DEAR P PLATO
I WAS PLAYING SALLY R IN TORPEDO AND I GOT SHIFT
OUT

. . . . TOM A . . . .

ANT WAR I THINK SHOULD HAVE A COUPLE OF WALLS WITH
CANNONS IN THEM SO THAT IT WOULD BE MORE EXCITING
0120120120120120120120120120120123453453450120123 45
JIDISIWIRI

. . . . PETER S . . . .

LESSON BOXES: EQUIVALENT FRACTIONS PRaCTICE
MODULE EQUIVALENT FRACTIONS

IT IS DUMI GAVE YOU THE RIGHT ANSAWER AND YOU DID NOT
GAVE ME THE RIGHT QACHINE BACK

. . . . RHODA F . . . .

YOU MADE AMISTAKE . . . . . .
. . . . . .
. . . . . .

. . . . LIZZIE LEE . . . .

DEAR PROGRAMER 75 I AM GETTING LESSONS I HAVE ALREADY
DON, I WOULD LIKE NEW LESSONS, IF YOU DON 7T MIND.
YOURS TRULY
LIZZIE LEE

. . . . BRIAN C . . . .

WHEN WILL YOU MAKE UP A NEW GAMEAGAME YOU SHOULD MAKE UP IS
ROLLBALL AND SLYFOX. . . .

. . . . JON C . . . .

WHY DID YOU
TAKE ME OUT
OF HORES RACE

. . . . BILLY B . . . .

I WAS Z O P T OUT OF MY GAME SLOT
(TRANZLATION) I GOT PUSHED OUT OF MY GAME SLOT . .
. . . . . .
. . . . . .

CHILDREN FIND LESSONS DIFFICULT - ASK FOR
HELP -EXPLANATIONS

. . . . DEBBIE

DON 7T MAKE IT SO HARD.

. . . . BILLY B . . . .

LESSON SPEEDWAY
MODULE MOLT. TECHNIQUES AND SUBTRACTION-1

IT WAS FAIRLY HARD
6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6
6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6
6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6

. . . . TOM A . . . .

I HAD A LITTLE TROUBLE GETTING OUT OF MULTIPLYING
BY USING ADDITTION AND I DIDN,T UNDERSTAD WHEEL
OF FORTUNE.

. . . . KITTY N . . . .

DEAR PLATO,IN SUBTRACTION WITH STICKS REVIEW I
DID NOT USE STICKS,WHY DID YOU USE THE TERM 7 7STOCKS 7 7
IF I DID NOT USE STICKS/ALL FOR NOW,
KITTY N

. . . . DEBBIE D . . . .

PLATO, ON PLATO I LEARND THAT YOUR
ELECTRICITY WAS RAN THROUGH TELEPHONE LINES.
BUT NOW I HAVE TO GO.
GOOD BYE PLATO SEE YOU TOMMAROW PLATO.

. . . . TOM A . . . .

WOULD YOU PLEASE SEND ME THE FORMULA FOR THE
OCTOPUS,AND CRAB.
TOM A

. . . . RHODA F . . . .
I DIDN 7T UNDERSTAND BASKETBALL FRACTION.
AND I STILL DON7T
SIGNED RHODA F

. . . . TOM A . . . .

DEAR PLATO
WOULD YOU
PLEASE LET ME KNOW HOW TO MAKE AN OCTOPUSS

. . . .

WELL IT SAID IF THERE WHERE ANY LESSONS I WOULD LIKE TO
SEE IN CHAPTER 9 I WOULD LIKE TO SEE SORTTING FRACTIONS

. . . . JON C . . . .

WILL YOU TELL ME WHEN I CAN WIN . . . .

LESSON SORT NUMBER NAMES WITH DECIMALS
MODULE MEANING OF DECIMAN FRACTIONS

H O W LONG DOES ,T IT TAKE TO FINISH IT.

. . . . BEN D . . . .

DEAR PLATO,
IN CHAPTER 9 I WOULD LIKE TO SEE MAKE A MONSTER NOT
COMMEN DEMINOMETER.

LESSON PICK A TUB
MODULE EQUIVALENT FRACTIONS

TO HARD PLATO

. . . . JON C . . . .

LESSON SORT NUMBER NAMES WITH DECIMALS
MODULE MEANING OF DECIMAL FRACTIONS

PLATO WHEN IT BE BEFORE I FINISH MY LESSON. . . . . .

CERL PEOPLE RESPOND TO CHILDREN'S COMMENTS

. . . . SALLY R . . . .

LESSON EGGDROPPER
MODULE MULT. TECHNIQUES AND SUBTRACTION-1

DEAR PLATO,
I THINK PLATO IS FUN. TELL WHO EVER INVENTED
IT IS VERY NICE TELL HIM THANK YOU FOR ME WILL YOU PLEASE.

O K I WROTE DR. BITZER, THE INVENTOR OF PLATO, AND GAVE
HIM YOUR MESSAGE.

LESSON MENTAL ARITHMETIC
MODULE MULT. TECHNIQUES AND SUBTRACTION-1

DEAR PLATO I TINK MY LESSNS HAVE BEEN KIND OF EASY, I WISH
YOU COULD GET ME SOME NEW GAMES PLEASE.

DO YOU PICK HARD RULES AND MAKE UP CHALLENGING PROBLEMS
IN LESSONS THAT GIVE YOU A CHOICE / MENTAL ARITHMETIC
CAN BE VERY CHALLENGING.

. . . . KITTY N . . . .

DEAR PLATO, IN WHEEL OF FOURTUNE I THINK YOU S
SHOULD LET US HAVE MORE THAN 5 TURNS.HOW CAN WE 7 7WIN A
FOURTUNR 7 7 WHEN WE ONLY HAVE FIVE TURNS AND ARE AFRAID
TO TAKE LARGE NUMBERS /

YOU CAN PLAY LIGHTNING GAME INSTEAD OF REGULAR GAME IN
WHEEL OF FORTUNE. THEN YOU CAN HAVE AS MANY TURNS AS
YOU CAN DO IN 200 SECONDS. GOOD LUCK.

. . . . RHODA F . . . .

I DON 7T
KNOW FRATIONS

THIS IS A GOOD TIME TO START LEARNING FRACTIONS
MR. GLYNN

. . . . PETER S . . . .

I DID NOT GET A NAFE TIME YOU CITED ON ME YOU PUT ME ON
GROH TOWN I WAS POST TO BE ON URBAND

LESSON HOW THE WEST WAS ONE
MODULE MULT. TECHNIQUES AND SUBTRACTION-1

L WON
THE GAME 4+1≠0 is 5 YOU HEAR ME I WON

CONGRATULATIONS ON WINNING.

4+1≠0 IS ACTUALLY 4, NOT 5. IT MEANS THE SAME AS 4+(1≠0).
WHEN A PROBLEM DOES NOT USE PARENTHESES. .THESE THINGS W
. . .THEN YOU SHOULD DO THE MULTIPLYING FIRST, AND THEN THE
ADDING. DON 7T JUST WORK A PROBLEM FROM LEFT TO RIGHT.
HERE IS THE ORDER TO FOLLOW; DO THE STUFF IN PARENTHESES
FIRST, THEN ≠ AND ≡, AND THEN + and -.

. . . . BILLY B . . . .

LESSON SORT EQUIVALENT FRACTIONS
MODULE EQUIVALENT FRACTIONS

DEAR PLATO
THIS LESSON IS HARD FOR ME
6 7*(6 7*(6 7 7*(6 7*(6 7*(6 7*(6 7*(6 7*(6 7*(6*

BE SURE TO ASK MRS. HAMILTON FOR HELP IF YOU GET STUCK.

TELL DAVE I WILL ASK FOR HELP NEXT TIME
6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6

. . . . RHODA F . . . .

I DID NOT WANT GAME SLOT
I WANTED MAIN SLOT

WHEN YOU ARE IN GAME SLOT, YOU CAN GO BACK TO MAIN SLOT
BY PRESSING D A T A.

. . . . KATHY B . . . .

LESSON NUMBER NAMES FOR TODAY
MODULE ADD + SUB FRACTIONS, UNLIKE DENOMS

PLATO,
THAT LESSON WAS . . . . . .
S T U P I D . . .
FROM, KATHY B

KATHY, WHY DO YOU SAY NUMBER NAMES FOR TODAY IS STUPID
/ / / MR. GLYNN

IT WAS STUPID BECAUSE IT CUT ME OUT OF IT
THE SECOND I GOT INTO IT . . .
SINCERLY,
KATHY B

PLATO,
THAT WAS A VERY, VERY DUMB SESSION. .
FURTHER MORE I PERSONALY THINK IT WAS A WASTE OF TIME . .
FROM KATHY B

IT DOES SOULD STUPID TO PUT YOU OUT OF DATES JUST WHEN YOU
GOT INTO IT. HAS THAT HAPPENED MORE THAN ONCE / /
MR. GLYNN

DEAR MR. GLYNN,
IT CERTAINLY
HAS . . .
SINCERELY, KATHY BROWN

DEAR PLATO,
YOU WROTE, GAME LIST NOW AVAILABLE, ...
THEN YOU CUT ME OFF . .
FROM ,SMART CAT, ... 6

MS. HAMILTON RESPONDS TO STUDENT'S COMMENTS

. . . . BILLY B . . . .

0120120120120120120120120120120120120120120120120120120120120120
I T W A S F U N P L A T O
012021012012012012012012012012012012012012012012012022

BILLY, GLAD YOU LIKED YOUR LESSON. MRS. HAMILTON

. . . . BETH D . . . .

DEAR PLATO
BETH DOTTER BETH DOTTER .../././/./././././././././ . /
BETH DOTTER BETH DOTTER BETH DOTTER BETH DOTTER BETH DOTT
BETH DOTTER BETH DOTTER BETH DOTTER BETH DOTTER BETH DOTT

BETH, PLEASE WRITE A NOTE WHEN YOU HAVE SOMETHING TO SAY, BUT NOT JUST TO WRITE YOUR NAME OVER AND OVER. THANK YOU MRS. HAMILTON

DEAR MRS. HAMILTON
I LIKI PLATO. . . .

HI BETH, I 7M GLAD YOU LIKE PLATO. SO DO I. MRS. HAMILTON

. . . . BOB C . . . .

I BETTER GET MORE CHOICES NEXT TIME ON PLATO OR I WILL BEAT YOU
UP. P S , BOB THE GREAT

WHO OR WHAT ARE YOU GOING TO BEAT, JEFF / MRS. HAMILTON

I THINK I SHOULD BET MORE TIME OR I WILL DESTROY ALL OF P L A T O . . . . . .

MY GOODNESS YOU ARE VICIOUS TODAY, BOB, I HOPE YOU ARE MORE TRANQUIL ON YOUR NEXT TURN, MRS. HAMILTON

. . . . BILLY B . . . .

LESSON SORT EQUIVALENT NUMBERS
MODULE EQUIVALENT FRACTIONS

I AM HAVING A LOT OF TROUBLE
((*(*(*(*(*(*(*(*(*(*(*(*(
((*(*(***(*(*((((((((((((((
*((((((((((((((((((((((((((((

BILLY, IF YOU ARE STILL HAVING TROUBLE ON YOUR NEXT TURN
TELL ME AND I WILL TRY TO COME AND HELP YOU. MRS. HAMILTON

NEXT TIME I WILL ASK FOR HELP
B I L L Y B R A A K A M P
6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6
P. S. T H A N K Y O U

LESSON MENTAL COUNTDOWN
MODULE MORE MULT. AND SUB. TECHNIQUES

I DO NOT UNDERSTAND THIS LESSON VERY WELL

CHILDREN ASK FOR CHOICES - CONTROL OVER
SELECTION OF LESSONS

. . . . SALLY A . . . .

DEAR PLATO. MY LESSONS WHERE KIND OF EASY AND KIND OF HAR
D. I WISH YOU COULD GIVE ME A LONGER LIST OF THINGS TO CHOO
SE FROM. BECAUSE WHEN ON SOMTHING YOU GIVE HER A LONG LIST
OF THINGS TO CHO

. . . . LESLIE E . . . .

DEAR PLATO, I WAS NOT IN BATTLE
SHIP AND PUT ME IN IT ANY WAY. WRITE BACK.
O. K. BONNIE
LESLIE E (BEAVER)

. . . . SALLY R . . . .

DEA PLATO, I WENT TO CHANGE MY NAME IN TORPEDO AND THE
Y SENT ME OUT OF IT, PLEASE PUT ME BACK IN IT

. . . . KATHY B . . . .

PLATO.
YOU SAID I HAD 10 MIN. LEFT IN MY SESSION
AND THEN HAD THE NERVE TO CUT ME OUT OF MY SESSION
MADLY, KATHY BARKER . . .

. . . . HOLLY F . . . .

DEAR PLATO . . . . . .
HOW COME YOU DIDNT GIVE ME HORSE RACE IN GAME SLOT

. . . . SHELLY S . . . .

DEAR PLATO I WANT TO SEE HIGH WIRE.
I WANT IT ON

CHILDREN TALK ABOUT OTHER TOPICS

. . . . KITTY N . . . .

DEAR PLATO, IN JANUARY I WILL GO ON A SABBADICAL TO
BISHIPSTON, WALES. DO THEY HAVE PLATO IN WALES /
I HOPE SO, TRULY,
KITTY N

. . . . DEBBIE D . . . .

TODAY WAS THE 76 TALLEN SHOW, I WAS DOING THE BUNNY
HOP. I DID IT WITH KITTY C ERICA D. AND PAULA L.
ERICA AND PAULA, WENT INTO THE AUDIANCE TO GET MORE
PEOPLE TO DO THE BUNNY HOP. B Y E

. . . . HOLLY F . . . .

DEAR MR. GLEN DO YOU KNOW MR. FERGUSON FROM HOCKEY.
YOU HAVE A SON NAMED BRIAN GLEN RIGHT . . . . . .
KYLE ISAKSEN IS ALSO ON THE HOCKEY.
FROM HOLLY FRANKLIN

. . . . SALLY R . . . .

I LIKE PLATO AND I WILL MISS PLATO BECAUSE IM GOING TO
MOVE TO KANSAS CITY KANSAS
PLATO I LIKE YOU BY, SALLY R.

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DEDICATION

To the children and their teacher who shared their experience.

Urbana, Illinois, 1977 Bernadine Evans Stake

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APPENDIX

LISTING OF: WHOLE NUMBER LESSONS, FRACTIONS LESSONS AND GRAPHS LESSONS

Index of Whole Numbers Lessons

A. Introduction to PLATO

PLATO and You

B. Addition Lessons

1. Facts and Computational Practice

Speedway
Mental Arithmetic
Make a Bundle
Horse Race Facts Practice

2. Basic Meanings and Writing Addition Problems

Adding Dogs
Adding Lengths
Real Life Addition Problems
Practice Writing Problems

3. Place Value and Algorithm

Addition with Sticks
Carrying in Addition
Addition Step-by-Step
Check-up on Addition

4. General Addition Activities

Column Addition
Hop Game
Problem Machine
Cross Number Game

C. Subtraction Lessons

1. Facts and Computational Practice

Speedway
Mental Arithmetic
Make a Bundle
Horse Race

2. Basic Meanings and Writing Subtraction Problems

Real Life Subtraction Problems
Practice Writing Problems

3. Place Value and Algorithm

Check-up on Subtraction (pre-test)
Subtraction with Sticks — Part 1
(establishes one "paradigm")
Subtraction with Sticks -- Part 2
(introduces the algorithm)
Check-up on Subtraction (post-test)

4. Counting Backwards Technique

Countdown
Mental Countdown
Ways to Subtract in Your Head

5. General Subtraction Activities

Hop Game
Problem Machine

D. Multiplication Lessons

1. Facts and Computational Practice

Speedway
Mental Arithmetic
Make a Bundle
Horse Race

2. Basic Meanings and Writing Multiplication Problems

Rubber Stamp (repeated addition)
More Rubber Stamp
Rubber Stamp Practice
Arrays
More Arrays
Arrays Practice
Bulletin Board (area)
Multiplication Is (meanings summary and review)
About Multiplication (introduces terms)
Real Life Multiplication Problems
Practice Writing Problems

3. Computation Techniques

Multiplication Using Repeated Addition (part 1)
Multiplication Using Arrays (part 2)
Multiplication Using Repeated Addition and the Commutative Property (part 3)
Multiplication Using Building Up (part 4)
Multiplication Using Doubling (part 5)
Multiplication by Breaking Up a Number (part 6)
Numberline Multiplication
Multiplication Using What You Know
Ways to Multiply (using different methods)
Multiplication Mission Impossible (an ongoing check-up of different methods)

4. Algorithm

Multiplying by a One-Digit Number
Check-up on One-Digit Multiplication
Multiplying by Numbers Ending in Zeros
Multiplying by a Many-Digit Number
Check-up on Many-Digit Multiplication

5. General Multiplication Activities

Parking Lot
Cutting Large Parking Lots
Egg Factory
Egg Factory without the Hen -- Part 1
Doubling Practice
Claim Game
Lines and Crossing Points
Horse Race Division Drill
Hop Game

E. Division Lessons

1. Facts and Computational Practice

Speedway
Mental Arithmetic
Make a Bundle
Horse Race

2. Basic Meanings and Writing Division Problems

Home Sweet Toadstool (repeated subtraction on the numberline)
Worms (grouping objects)

Gimme! Dividing by Sharing
Egg Factory: One Crate and One Basket
Egg Factory without the Hen -- Part 2 (division)
Division Is (summary and application of meanings)
Real Life Division Problems
Practice Writing Problems

3. Computation Techniques

Dividing by Trying Numbers to See if They Fit
Numberline Division
Dividing by Subtracting
Dividing into Equal Parts
Repeated Subtraction with Good Numbers (expanded algorithm)
Ways to Divide (using different methods)
Divide and Conquer (an ongoing check-up on different methods)

4. Algorithm

Introduction to Long Division
Introduction to Long Division (cont.)
Long Division Practice

F. Renaming and Symbols

1. Renaming

Names for Today's Date
Problems in Arithmetic
Recrating at the Egg Factory (distribution)
Egg Factory without the Hen -- Part 3 (distribution)

2. Generating Specific Numbers

How the West Was Won
Blackboard
Pitcher Pouring Problems
Four Fours

3. The Language and Grammar of Arithmetic

Think of a Number
Math Shorthand (translating problems into symbols)
About...Number Sentences
About...Parentheses
My Dear Aunt Sally (the order of the four arithmetical operations)

4. "Creative Writing" in Mathematics

Your Way
True-False Game

5. Inverse Operations

Undo It

G. Place Value

1. Numbers in Words

Numbers in Words
Wheel of Fortune

2. Counting and Number Games

One Million
Mailbox
Skip Counting with Cars
Hop Game

3. Place Value

Place Value Problems
Check-up on Place Value

H. Word Problems

By Kids (problems made up by children)
Ant War
Real Life Story Problems
Man Flies to the Moon
Practice Writing Problems

I. Miscellaneous

Hockey (estimating angles and reflections)

Appendix A Data for Teachers

Index of Fractions Lessons

A. Meaning of Fractions

1. Simplified Curriculum Chart

2. Lesson Descriptions

Share a Candy Bar
Share Jumping Beans
Cut and Paint
Fraction Notation
Paint and Compare
Paintings Library
Sticks 'n' String
Lights
Lights: Equivalent Fractions
Check-up for Meaning of Fractions

B. Mixed Numbers and Fractions $\geq$ 1

1. Simplified Curriculum Chart

2. Lesson Descriptions

Pizza

Fractions
Cutter Stuck
2 Pizzas for 3 Kids
2 Pizzas for 3 Kids--Generalized
Mixed Numbers Introduction
Mixed Numbers with Pizza

Pizza: Remedial Cutter Stuck
Pizza: Remedial Equivalent Fractions
Skywirting and Spider Web
Units
Make-a-Monster
Sticks 'n' String
Try These: Fractions and Mixed Numbers
Try These: Equivalent Mixed Numbers
Vocabulary: Whole Number, Fraction, Mixed Number
Sort Numbers by Form
Number Line: Whole Numbers
Mixed Number Notation
Darts
Check-up for Mixed Numbers and Fractions $\geq$ 1
Check-up for Number Line

C. Equivalent Fractions

1. Simplified Curriculum Chart

2. Lesson Descriptions

Boxes: Equivalent Fractions
Boxes: How Much Is Painted?
Lights: Equivalent Fractions
Pick a Tub
Splash!
Pizza: Remedial Equivalent Fractions
Pizza: Remedial Cutter Stuck
Boxes: Name Equivalent Fractions
Boxes: Equivalent Fractions Practice
Make-a-Monster: Equivalent Fractions
Sort Equivalent Fractions
Equivalent Fractions Generalized
Sort Equivalent Numbers
Try These: Equivalent Fractions
Introduction to Simplest Terms
Simplest Terms
Pizza: Common Denominator
Make-a-Monster: Common Denominator
Equivalence Experience
Torpedo
Check-up for Equivalent Fractions

D. Addition and Subtraction (Like Denominators)

1. Simplified Curriculum Chart

2. Lesson Descriptions

New Answer Format
Addition and Subtraction of Mixed Numbers with Like Denominators
Sort Equivalent Problems
Target Practice
Fractions Basketball
Simplifying Answers to Addition Problems
Standard Form Practice
Addition Practice, Simplifying Answers
Addition and Subtraction Drill
Subtraction with "Borrowing"
Addition and Subtraction Practice with Simplifying and "Borrowing"
Check-up for Addition and Subtraction (like denominators)

E. Addition and Subtraction (Unlike Denominators)

1. Simplified Curriculum Chart

2. Lesson Descriptions

Heuristics I
Paint Addition: PLATO Paints
Heuristics II
High Wire
Heuristics III
Heuristics III Practice
Paint Addition: Student Paints
Addition and Subtraction Drill
Target Practice
Fractions Basketball
Heuristics IV
Heuristics IV Practice
Paint Addition: Choice
Inequalities with Like Denominators
Addition with Equivalence Sets
Addition and Subtraction Practice with Equivalence Sets
Strategies for Listing Sets
Heuristics Review
Inequalities with Unlike Denominators
Check-up for Addition and Subtraction (unlike denominators)

F. Multiplication of Mixed Numbers

1. Simplified Curriculum Chart

2. Lesson Descriptions

Introduction to Multiplication of Mixed Numbers
Multiplication Practice with Pictures for Help
Multiplication of Fractions
Strategies for Multiplying Mixed Numbers
Mixed Number Multiplication Practice
Check-up for Multiplication of Mixed Numbers

G. Meaning of Decimal Fractions

1. Simplified Curriculum Chart

2. Lesson Descriptions

Decimal Darts
More Decimal Darts
Decimal Names for Fractions
Fraction Names for Decimal Numbers
Decimal Torpedo
Obstacle Course
Sort Number Names with Decimals
Decimal Pinball
Check-up for Meaning of Decimal Fractions

Index of Graphing Strands

A. Graphing Substrand

a. tic tac toe
b. battleship
c. how to plot points
d. checkup for tic tac toe
e. from open sentence to table
f. introduction to linear graphs
g. linear graphs — slope
h. linear graphs — intercept
i. box + hex = 6
j. over-ups
k. slope checkup
l. ttt (4 quadrants)
n. intercept checkup
o. experimenting with linear graphs
p. problems with linear graphs
q. graphing parabolas
r. experimenting with parabolas
s. graphing hyperbolas
t. experimenting with hyperbolas

(NEXT for second page)

a. graphing ellipses
b. experimenting with ellipses
c. easy graphing
d. how do you feel about today's work?

B. Signed Numbers Substrand

a. introduction to signed numbers
b. eggdropper
c. postman stories +, - (1)

d. postman stories +, - (2)
e. postman stories +, - (3)
f. postman stories x (1)
g. postman stories x (2)
h. postman stories x (3)
i. post check +/- (1)
j. post check +/- (2)
k. post check +/- (3)
l. post check x (1)
m. post check x (2)
n. post check x (3)
o. cricket (not being used)

C. Variables Substrand

a. boxes and hexes
b. true, false and open sentences
c. first lesson in open sentences
d. second lesson in open sentences
e. rule for substitution
f. quadratics (1)
g. quadratics (2)
h. quadratics (3)
i. making up identities

D. Functions Substrand

a. guess my rule (new version)
b. guess my rule (old version)
c. guess my rule checkup (old version)
d. finite differences (1)
e. finite differences (2)
f. finite differences checkup
g. finite differences (3)
h. shuttle puzzle (game)
i. shuttle puzzle (number of moves)
j. shuttle puzzle (gmr)
k. experimenting with exponents
l. exponents checkup
m. one meaning of exponents
n. tower puzzle (game)
o. tower puzzle (minimum number of moves)
p. tower puzzle (gmr)
q. 2 to box gmr